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LOWER BACK PAIN*

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Ottawa

WHILE it is no doubt true that the pain complained of by the majority of patients in the lower back is real, still the pathology underlying the particular type of pain is not well known. As a result the diagnosis of low-back conditions is often incorrect. It naturally follows that the treatment will be often misdirected and inadequate. If sufficient interest can be aroused to induce the clinician to follow his low-back cases to autopsy, and, jointly with the pathologist and anatomist, review their clinical history and physical findings, noting in each case any departure from the normal as disclosed by careful dissections, etc., we will be in a better position to place the diagnosis and treatment of painful backs with their referred pains on a sound foundation.

It will be necessary in carrying out the above scheme of investigation to segregate the cases into (1) those endeavouring to obtain financial remuneration; (2) those seeking only relief from pain; (3) those who never had any complaint of low-back disturbance. The last would constitute a normal standard for comparison. Through proper organization the anatomical departments of our universities could demand a complete history when and where available in relation to each subject entering their department. After a reasonable period of time we would have some data that would be most helpful.

It is generally admitted that the commonest causes of low-back pain are (1) arthritis, in its broadest aspect; (2) posture; (3) trauma. Bad posture and trauma, if long continued, will by themselves bring about arthritic changes.

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The lumbo-sacral region (Fig. 1) will first be considered, as it probably is most commonly the seat of trouble, being the meeting point of two long levers, the entire spine and head above and the pelvis and lower limbs below. It is also agreed that the slanting or oblique platform of the upper surface of the sacrum is not well

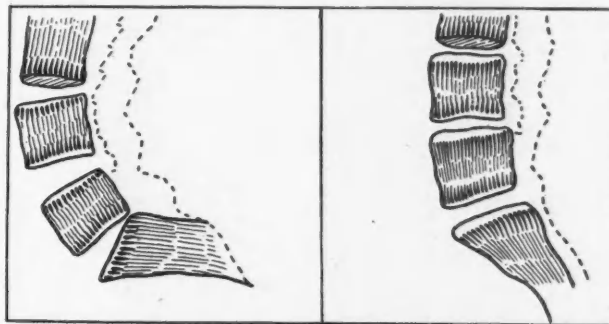


Fig. 1 (left).—Horizontal sacrum with increased lumbar sacral angle; tendency for forward and downward slipping of fifth lumbar on sacrum and added strain on lumbar sacral ligaments, etc. Rotation has taken place through a horizontal transverse axis at the sacro-iliac joint and the hip joint proper, with added strain on the ligaments, etc. supporting the sacro-iliac joint. Fig. 1 (right).—Lumbar sacral region sacrum tends to be more vertical; superior surface is horizontal and not oblique, giving a firm base of support for the superincumbent weight.

adapted for the upright posture, being originally designed for the all-fours position. The superior surface of the sacrum being inclined downward and forward, there is always a tendency for the fifth lumbar and the vertebræ, etc., above to slide downward and forward into the pelvis, a variable shearing strain. If the lumbo-sacral angle is increased, that is, lumbo-sacral lordosis, the sacrum will be more horizontal than normal and the superior surface of the sacrum will tend to approach the vertical, which will increase the shearing strain and place an extra amount of work and tension on the muscles and ligaments

that support this joint. This, of course, means pain and tenderness locally and even referred pains to various areas in the lower limbs. This increased forward inclination of the sacrum may be accomplished by a rotation on a transverse axis at the second sacral vertebra, the superincumbent weight tending to still drive the upper end of the sacrum downward and forward into the pelvic cavity. Any great advance of the sacrum in this direction is prevented by the ligaments and muscles supporting the sacro-iliac joint, so it is quite obvious that any change from an established normal lumbo-sacral lordosis for certain types of individual is a potential factor for mechanical disturbances, not only at the lumbo-sacral joint but at the sacro-iliac as well.

Articular facets (Fig. 2).—The articular facets are adjacent and component parts of small apophyseal joints at the sides of the spine,



Fig. 2.—Chronic traumatic or postural destruction of the lower lumbar and lumbo-sacral intervertebral discs (retouched). Note the subluxated facets and constricted foramina.

and act as gliding planes or stabilizers. They are covered on the opposing surface with hyaline cartilage. These are true joints having capsules and synovial lining, as well as small sensory nerve twigs to the capsule and synovia, which is a potent factor for causing pain, local and referred. The articular processes with the facets form the posterior boundary of the intervertebral foramen for the passage of the anterior and posterior spinal nerves. When the spine in the lumbar sacral region is forced into extension (that is, bending backwards) these facets

over-ride one another and diminish the vertical diameter of the foramen. When the lumbar spine is bent forward (flexion), the reverse takes place and the foramen is enlarged vertically, giving more space for the spinal nerves.

Intervertebral discs.—The bodies of the vertebrae are separated by fibro-cartilaginous discs composed of an incompressible, gelatinous substance (nucleus pulposus) which is encased by a very strong fibrous covering at its circumference (annulus fibrosus) and limited superiorly and inferiorly by the cartilaginous plates. The two, that is, the casing and its contents, act as a buffer or shock absorber to compressive forces. Trauma, acting as a compressive force, may (1) break the cartilage plate with escape of the gelatinous nucleus into the cancellous substance of the vertebral body; or (2) cause the escape of nucleus backward into the spinal canal, producing pressure on the nerves, with referred pain along the course of their distribution. Either of the above conditions will cause a diminution of vertical diameter of the disc, and allow in time the vertebral bodies to approximate, with over-riding of the facets, and decrease in the size of the intervertebral foramen with possible constriction of the nerve in exit at this point. The same condition may take place in arthritis of any type that destroys the disc.

There are a number of abnormal variations at the lumbo-sacral region that may give rise to pain, local and referred, such as a change of the plane of the articular facets from the mechanically stable internal external type (sagittal) to the anterior posterior (coronal), or again they may be asymmetrical, that is, a combination of the two types. The latter allows motion to take place in opposite directions, and one of the small stabilizing joints is very liable to be strained and eventually undergo arthritic change from multiple small traumata.

Posterior displacement of the fifth lumbar on the sacrum takes place with greater frequency when the anterior posterior type of facet is present. This displacement causes a decrease in the size of the foramen and pain, local and referred, usually into the sciatic nerve. Complete bilateral bony union of the fifth lumbar transverse process to the sacrum makes for a more stable lumbo-sacral joint. Incomplete or fibrous union on one or both sides usually does not cause trouble, except that we have a false joint that may undergo arthritic change.

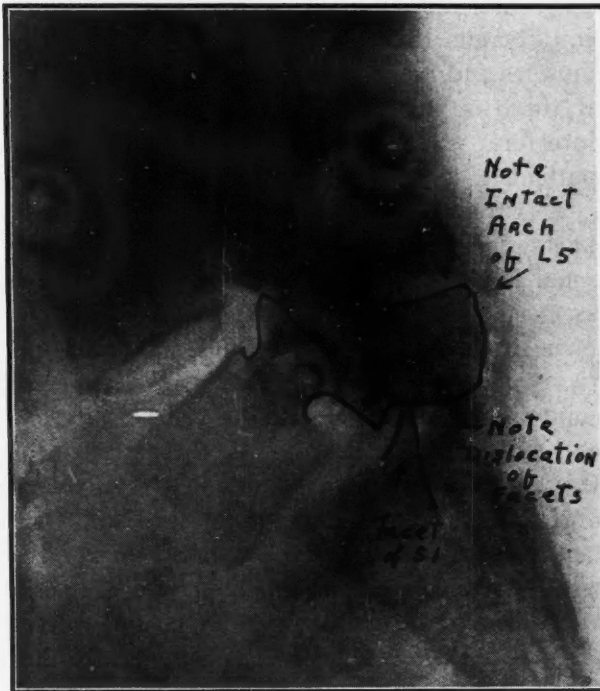


Fig. 3

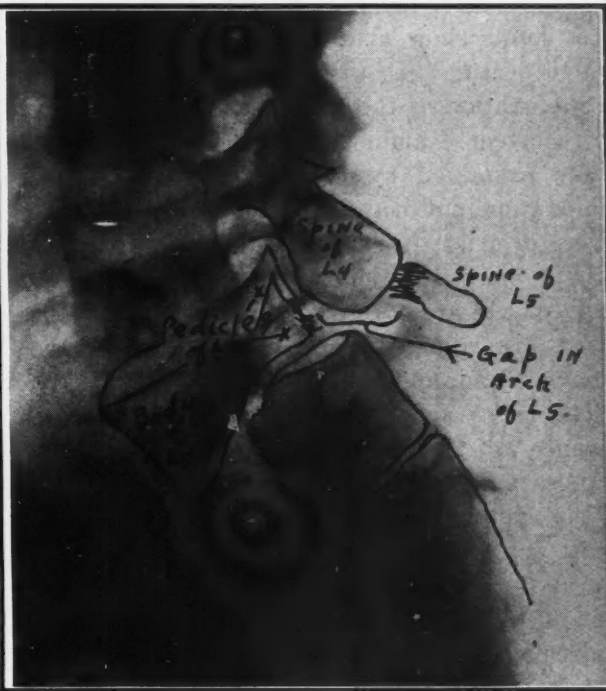


Fig. 4

Fig. 3.—Traumatic dislocation of fifth lumbar. Note that the arch of the fifth lumbar is intact. The spine and laminae have travelled forward with the body. The facets of fifth lumbar are now anterior to those of first sacral. The fifth lumbar is sharply tilted anteriorly on the first sacral, while displacement is still moderate, with marked posterior tilt of the sacrum. These features emphasize the difference between traumatic displacement and spondylolisthesis. **Fig. 4.**—Spondylolisthesis. The laminae of the fifth lumbar are ununited to the pedicles. With displacement the spine and laminae are left behind, while the body goes forward.

Lack of fusion of the first sacral or fifth lumbar lamina gives a poor attachment for ligaments, and in this sense may be a potential factor of pain, especially if associated with other anomalies. Spondylolisthesis (Figs. 3 and 4) of the fifth lumbar vertebra is due to a break in the continuity of the neural arch between the superior and inferior articular facets. It is a congenital lack of fusion at the above point, and if bilateral will permit the superior facet and body of the fifth lumbar to move forward along with all the vertebrae above, the inferior articular facet, lamina, and spinous process of the fifth lumbar remaining back in their normal relation with the sacrum. This deformity may seriously interfere with the nerve passing through the foramen between the fifth lumbar and sacrum.

The sacro-iliac joint (Fig. 5) is normal and free from arthritic changes up to thirty years of age, and is very strongly protected by ligaments against any motion beyond a few degrees on a transverse axis, that is, anterior posterior motion and a slight gliding up and down. This motion disappears after the fourth decade in

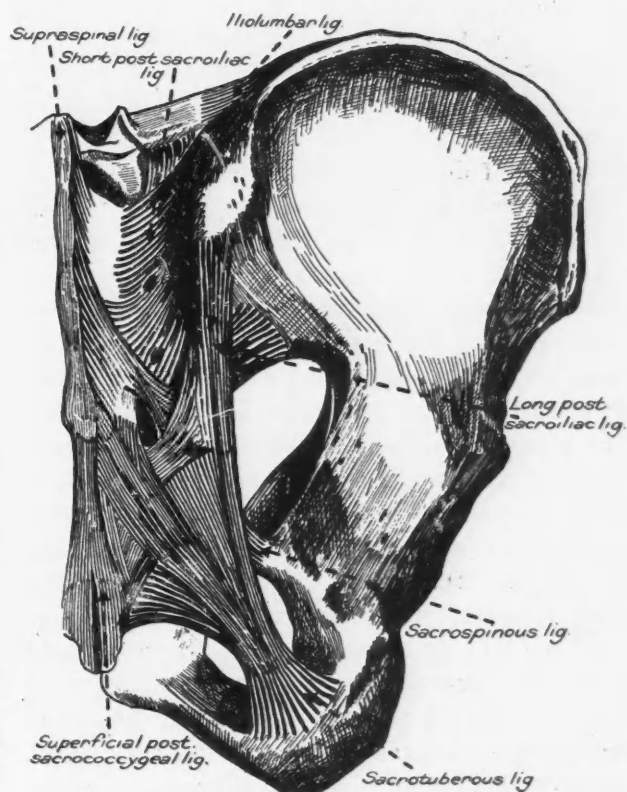


Fig. 5.—Posterior surface of the sacro-iliac joint showing the supporting ligaments.

males and after the sixth decade in females, and most joints show arthritic changes beyond the fourth decade (Sashin).

Subluxation of the sacro-iliac joint is rare in post-mortem examinations. Of 257 sacro-iliac joints examined by Sashin only two showed subluxation, and both came to autopsy following severe injuries; in each case the separation was only 1 cm. The joint surfaces up to thirty years of age are covered with hyaline cartilage. There are a joint space, synovial membrane, synovial fluid, and slight motion.

The male sacro-iliac joint ages ten years in advance of the female, that is, degenerative changes and limitation of motion appear early in the male and progress at a more rapid rate. Bony ankylosis was present after 60 years of age in the 257 sacro-iliacs examined, in 80 per cent of the male joints, and in 30 per cent of the female joints. These changes are to be expected, as the entire superincumbent weight passes through these joints, which together with the sudden twists and jars damage the articular cartilage as well as the supporting ligaments. These ligaments contain small sensory nerves, which, becoming irritated, cause local pain and tenderness and even referred pain down the lower limbs.

Man in his upright or erect attitude is prevented from falling forward to the all-four position by combined action of the postural and contractural tonus of the muscles of his back and lower limbs, the ligaments making the second line of defence. The nerve supply to these structures in the back consist of both motor and sensory branches of the posterior spinal nerves, along with a few branches from the anterior spinal nerves; any strain or sprain, acute or chronic, or muscular fatigue, even nervous fatigue, will produce changes in these tissues, causing the liberation of substances that irritate the nerve endings, making them hypersensitive. While ligaments, fascia, aponeuroses and tendons are parts of low sensibility, and the nerves in them are scarce, still when they receive painful stimuli they give rise to local tenderness and pain referred to a more sensitive area localized in the lower limbs. Even a mild stimulus repeated over a long period of time, as in a case of chronic muscular insufficiency or muscular decompensation of the back, gives rise to a cumulative effect which finally expresses itself as a reflex neuralgia. Any area which is under such continuous strain as is the lower

back must at all times maintain a perfect equilibrium between the bony structures and muscles and ligaments. This will not be possible if there is any systemic involvement that will interfere with the general well-being of the patient.

A careful history is of first importance, particularly in relation to the family or personal history and physical findings of arthritis, as most patients with low back pains have some form of fibrositis, myositis, and muscular fasciitis, etc. (Albee). The fascial planes are really joint spaces lined with mesothelium. The nerves and lymphatics pass through these spaces. If this mesothelial lining is inflamed these nerves are also involved, adhesions form, and free motion between the muscle layers is interfered with, circulation is impeded, and the function of the muscles is seriously handicapped. Areas of local tenderness will be discovered over these places by careful palpation, and relief will follow removal of any foci of infection, paying particular attention to intestinal stasis, physiotherapy locally, and manipulation if adhesions are present. Palpation will often reveal very small tender areas at the insertion of certain ligaments and tendons or aponeuroses to the bone. Pressure on these areas will set up certain radiations in the lower limbs, and tension on these ligaments, etc., increases the pain locally. Injection of these painful parts with procaine hydrochloride (1 per cent) not only suppressed the local pain and tenderness but the referred neuralgia as well, proving that the lesion was in the ligaments and was not due to pressure on a nerve root. It is a reflex phenomenon initiated at the nerve endings, in the ligaments, etc.

The symptoms and signs of low-back conditions may range from a dull ache without referred pain, with free motions in all directions, to severe pain with tenderness, limited motion, spasms, lists to or away from the lesion (Fig. 6), and severe referred neuralgia. When there is compression of a nerve, as in an abnormally small foramen, neuritis may follow, with definite neurological findings along the distribution of the nerve. The fifth lumbar neural canal is the smallest of lumbar neural canals and the fifth lumbar nerve is the largest, hence the narrow margin of safety in a hypermobile fifth lumbar vertebra.

It is not always possible definitely to differentiate a lumbo-sacral from a sacro-iliac dis-

turbance, and vice versa, but as a rule the area of local tenderness between the fifth lumbar and first sacral spinous process indicates an involvement of the supra-spinous ligament, and may mean a strain of this joint. If hyperextension increases the pain at the lumbo-sacral region certain structures may have been pinched by approximation of the spinous process at this point or between the fourth and fifth lumbar vertebrae. Tenderness over the posterior sacro-iliac ligaments, etc., would indicate an involvement of the sacro-iliac joint. There are a number of other tests, but none have proved entirely satisfactory and will be omitted. The x-ray, of course, will give most valuable information.

ROUTINE EXAMINATION

The basic routine examination of the lumbo-sacral area with x-ray should consist of: (1) a true antero-posterior view; (2) a true lateral view; (3) an antero-posterior view, oblique from below upward, commonly called the 45° view, which is of great value in the study of the sacro-iliac joints, the sacrum, the state of fusion of the sacral wings, the transverse processes of the fifth lumbar vertebra with their relation to the sacrum, and the condition of the arch of the fifth lumbar vertebra; (4) a lateral view of the lumbo-sacral region when standing.

The lumbo-sacral angle should be more acute when standing than when lying, due to a slight sagging of the pelvis forward on standing. If, however, there is a mechanical weakness which is producing symptoms, the patient on standing tilts the pelvis backward by muscular action so as to reduce the lumbo-sacral angle and bring the sacrum more under the line of the thrust of the weight. For this reason the lumbo-sacral angle when standing may appear worse in a normal subject than in one who has lumbo-sacral weakness. If the latter condition is present it would point to a lumbo-sacral and not a sacro-iliac involvement. The three joints are so closely related that forces which affect one usually also in a degree change the relation of the component parts of the other joints, with resulting symptoms of pain and tenderness in all three. So much so is this true that Chandler fuses the three joints by a tri-sacral fusion. X-rays should always be taken in two positions of the lumbar spine to rule out vertebral disease neoplasms and fractures, etc. Intra-pelvic trouble is more often overestimated than underestimated as a cause of low back pain. Cabot

believes that there is no type of backache or reflex pain that can be definitely referred to pelvic disease. All intractable or stubborn cases should have an examination by a urologist, a neurologist, and, in females, by a gynaecologist.

Whenever we have deviation of the spine in the lumbo-sacral region, as for example a pinching of structures between the transverse process and the sacrum on the right side, muscular action on the left pulls the body to the left and maintains it there. If this deviation to the left is of long duration adaptive shortening takes place in the fibrous sheaths of the muscle fibres as well as compensatory shortening of the ligaments on the left side. Any attempts to correct this habitual attitude suddenly cause a tearing of these shortened structures, which results in tenderness and pain. The deviated position is a constrained one, and, due to muscle fatigue, will cause pain, local and referred (Fig. 6).

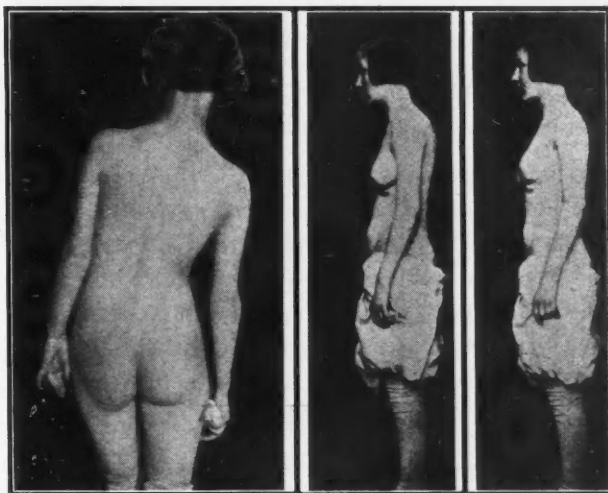


Fig. 6

Fig. 7

Fig. 6.—Sciatica on the left, with a list of the body to the right (sciatic scoliosis). Fig. 7.—Note the bad posture in a patient with the infectious type of arthritis. After a year's training note the improvement in posture.

TREATMENT

As arthritis is given as the commonest cause of low back pain, a thorough search should be made for any possible foci of infection or toxæmia, paying particular attention to intestinal stasis. Faulty posture, such as a round back (Fig. 7), a round hollow back, or inequality of the length of the lower limbs should receive immediate attention. As the hip flexors and the erector spinæ increase the lumbar-sacral lordosis they should first be stretched, if found shortened. Along with this stretching certain muscles should be developed, namely, the gluteus maximus and

the anterior abdominals, as they by their contraction lessen the lumbar lordosis (Figs. 8 and 9).

If the intervertebral disc has been destroyed by trauma or disease actual compression of the nerve may cause a definite neuritis. The facets often impinge on the pedicles above and the

mid-sternum to above the symphysis pubis anteriorly. This will maintain the reduction of the lumbo-sacral lordosis. After removal of the cast a brace or corset is fitted to follow out the same principles of treatment. Low heels should always be worn, as any raising of the heel of a shoe forces the body forward, and only by contraction of the erector

spinae, etc. is it pulled back again into extension with increase of the lumbo-sacral lordosis, which is a position to be avoided (Figs. 10 and 11). Some cases will not respond to conservative measures and a lumbo-sacral fusion will be necessary. The lumbo-sacral fusion should be combined with the removal of the articular facets (facetectomy) where radiation to the lower

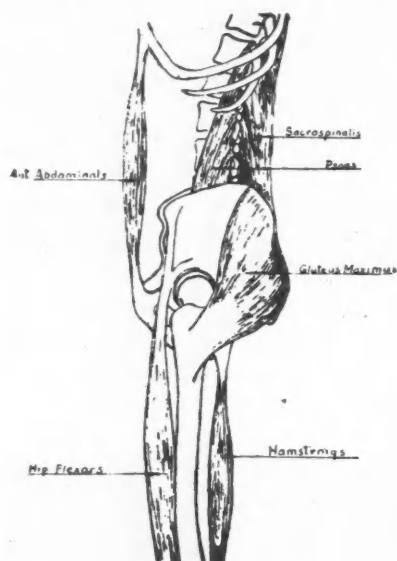


Fig. 8

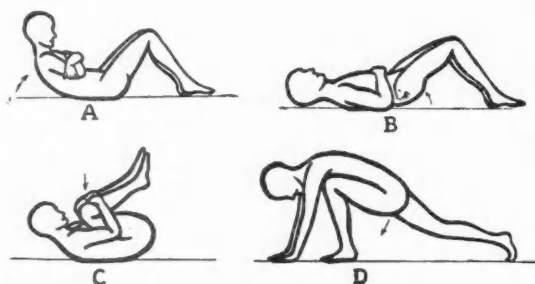


Fig. 9

Fig. 8.—Schematic drawing of the principal muscle groups which affect the posture of the lower spine. Fig. 9.—Postural exercises designed to reduce the lumbar sacral angle. (a) Active development of the abdominal muscles; (b) of the gluteal and hamstring muscles; (c) stretching of the erector-spinae or sacro-spinalis; (d) stretching of the hip flexors.

lamina below, causing friction with a reaction in the periosteum and bone which no doubt causes pain. If after a reasonable trial of stretching the tight muscles and developing by exercises the abdominals and gluteus maximus, disability is still present, a cast is applied with the patient bent forward, extending from the upper dorsal to the lower sacrum posteriorly and from the

limbs is a prominent feature and where x-ray shows a marked diminution of the intervertebral foramen, as by the latter procedure the foramen is enlarged. Spondylolisthesis when giving local and referred pain also calls for a combination of the Hibbs and Albee type of lumbo-sacral fusion (Fig. 12). Some patients have pain at the lumbo-sacral region increased by bending backwards, and are relieved by removing a part of the spinous processes, giving more space for soft tissues and preventing bony impingement with resulting periosteal irritation. Those who show in the cerebrospinal fluid a total protein content of over 40 mg. per cent should be examined by a neurologist for a possible posterior prolapse of the nucleus pulposus or pressure from an enlarged ligamentum flavum, with the view to performing a laminectomy and removal of nerve-root pressure, along with a Hibbs' fusion to stabilize this area.

Some cases with chronic pain in the lower back, with lumbar rigidity and severe radiating pain along the outer side of the leg and into the gluteal regions, can be greatly benefited by applying a cast from the toes to axilla, incorporating the extremity affected by the referred pain. The cast should remain on until all local and referred pain has disappeared, which is usually about six weeks. After the



(a) (b) (c)

Fig. 10.—Showing effects of high heels. (a) Plumb line shows where weight strain comes on the heel. (b) With three-quarter inch heel, plumb line or weight strain swings forward on arch. (c) High heels throw strain on metatarsal heads. Raised heel inclines the body forward, which is corrected by the muscles of the back, increasing the lumbar sacral forward angle, or lordosis.

cast is removed a spinal brace is worn whenever signs of a recurrence are in evidence.

Injection of saline into the sacral hiatus relieves some cases that have intra-spinal adhesions. Manipulations are helpful if adhesions are present, but caution should be taken against too vigorous and forceful movements of the lumbar spine, as in some cases fifth lumbar root symptoms have occurred by causing a posterior prolapse of the nucleus pulposus. Freeing fibrous bands crossing the sciatic nerve, division of fascia lata, as well as stripping the ligaments and muscular attachments from the posterior superior spine region are useful procedures in selected cases.

is referred pain. Such patients should remain in bed two weeks after all pain has disappeared. It is most important for the surgeon to maintain an optimistic attitude in treating these cases in order to prevent a possible traumatic neurosis. All back cases should be instructed how to stoop by first contracting the abdominals and bending at the hips and knees, and not bending the lumbar spine, lessening in this way the chance of a muscle or ligamentous strain or even a locking of the facets in flexion or extension.

Sacro-iliac slips may occur but these have not been proved by x-ray. There are a number of manipulations given for these joints that at

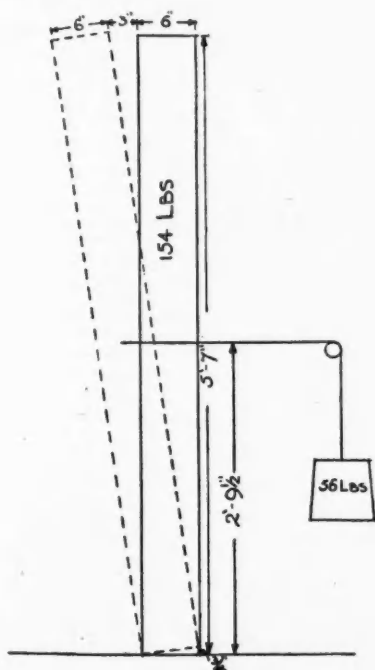


Fig. 11

Fig. 11.—Effects of heels on the spine. The upright pillar, 5 feet, 7 inches in height, 154 pounds in weight, is tilted forward by a three-quarter inch raise of heel, 9 inches from the vertical, and requires 56 pounds of muscle energy to restore it to vertical position.

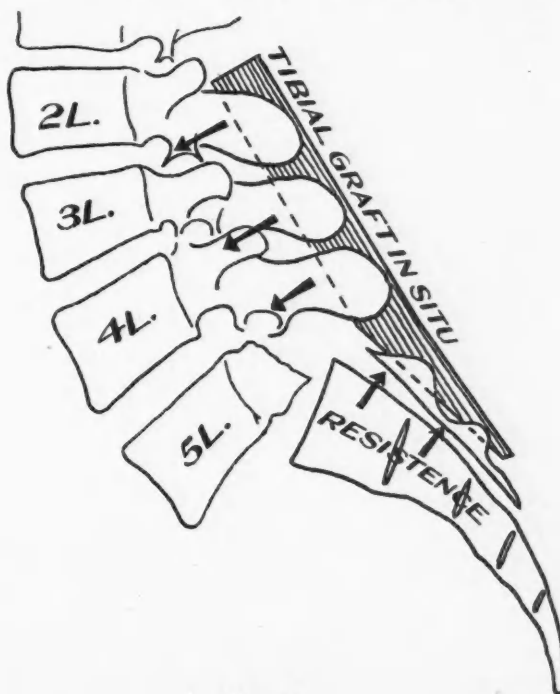


Fig. 12

Fig. 12.—A tibial graft in conjunction with the Hibbs' spinal fusion gives a solid bridge of bone extending from the second lumbar to the sacrum, thus relieving shearing strain and preventing increase in the forward displacement of the fifth lumbar, etc. in spondylolisthesis.

Raising the shoe on the opposite side to the lesion causes the patient to list to the high side, and this opens the foramen on the low side, with release of pressure on nerves, etc., but sometimes the heightening will cause symptoms on the unaffected side and then should be removed. Adhesive traction to the lower limb will sometimes relieve those cases that have lower back pain with radiation along the course of the nerves, whether they are acute or chronic, and should be used in acute traumatic cases. Traumatic cases should have bed rest, with adhesive strapping, physiotherapy, and leg traction if there

times are very dramatic in their results. These are described in the standard textbooks on manipulations, but we believe these reductions are the result of lumbo-sacral shifts rather than of subluxated sacro-iliac joint replacements. Before any operations such as lumbo-sacral fusion are performed the exaggerated lumbar lordosis should be first corrected, as well as any obliquity of the pelvis. Sacro-iliac fusion is indicated (1) in a tuberculous involvement of this joint; (2) also when we are thoroughly convinced that the sacro-iliac joint is the cause

of the signs and symptoms presented that have not responded to conservative measures after a reasonable period of time.

Sometimes when bending backward the fifth lumbar glides posteriorly on the sacrum, and, instead of gliding forward to its normal position when the patient bends forward, it simply

tilts forward on a transverse axis but still remains displaced posteriorly, and in this displaced position causes narrowing of the foramen, and symptoms local and referred. These cases are relieved by a Hibbs' fusion.

NOTE.—A comprehensive bibliography has been prepared and may be had on application to the author.

MULTIPLE PATHOLOGICAL FRACTURES CAUSED BY TUBERCULOSIS

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THE occurrence of multiple lesions of tuberculosis associated with Pott's disease is common. The following case is reported because the original lesion in the vertebral column had the roentgenological appearance of malignancy, and was later followed by a large number of pathological fractures of ribs, all of which were, however, due to tuberculosis.

CASE REPORT

On March 8, 1937, a man aged 54 years, was admitted to the Toronto Hospital for Consumptives for treatment of pain in the back. He had been ill only once before (in 1918) during the influenza epidemic, when he had an attack of influenza associated with pleurisy and effusion on the right side. The family history was negative. The back pain had commenced in March, 1936, while he was engaged at his customary occupation of operating a machine in a furniture factory. The pain was in the upper lumbar region, and was typically spinal in origin, being referred around the trunk to the front of the body, and being aggravated by activity and relieved by resting flat on the back. It steadily grew worse, and was not affected by the extraction of his teeth. Several months after the onset he noticed a small bony prominence in his spine.

For a period of eight weeks in July, 1936, he remained strictly in bed, after being seen in consultation by Dr. N. Shenstone, who diagnosed Pott's disease. Termination of the period of immobilization was promptly followed by a return of pain.

In October, 1936, he became very ill, with chills and fever, and returned to bed. This partially relieved his back pain, but his condition did not improve, and in January, 1937, he was admitted to the local hospital and in February was transferred to Toronto. X-ray films of the spine made at the Toronto General Hospital revealed almost complete destruction of the ninth dorsal body without any apparent thinning of the adjacent intervertebral discs. X-ray films of the chest gave no evidence of tuberculosis or of new growth, and roentgenological examination of the gastrointestinal tract was negative. There was no Bence-Jones protein in the urine. A tuberculin test showed a positive reaction of average intensity. He was febrile. The former diagnosis of Pott's disease was confirmed. He was immobilized in plaster and was sent to the Toronto Hospital for Consumptives.

The progress of the disease during the following ten months may briefly be summarized as follows.

On arrival at the hospital, in addition to his spinal disease he had pain and a pleural friction rub on the right side of the thorax, and a pleural effusion rapidly

developed. This was aspirated and cultured, and tubercle bacilli were grown from the fluid. Although he coughed occasionally, the cough was slight and he never expectorated purulent sputum, nor were tubercle bacilli ever found in his sputum on concentration or on culture. Physical signs of pulmonary tuberculosis were lacking. His temperature, high and hectic at first, gradually fell to within normal limits. During the last four months, however, there were many occasions when the temperature again became elevated. His appetite was excellent and he slowly gained weight until the last four months, during which time he slowly lost weight. Occasionally he had faecal incontinence, but in general he tended to be constipated.

His spine was kyphotic in the lower dorsal region, but he felt quite comfortable in his plaster shell. His first sacral spinous process was unduly prominent, and this was found by x-ray examination to be due to spondylolisthesis. Serial x-ray films of the spine made by Dr. W. J. Cryderman revealed complete destruction of the ninth dorsal body but no other bony changes. A small paravertebral abscess was aspirated through a posterior approach, between the eighth and ninth ribs, close to the spine. Some necrotic material was obtained, and this, on culture, yielded tubercle bacilli, giving indisputable evidence of tuberculosis.

For six months his condition remained stationary. Then one day he complained of pain in the left upper anterior thorax on coughing and on deep inspiration. Examination revealed a small, rounded irregularity on the anterior surface of the left first rib, near the sternum, and this spot was very tender. One week later bony crepitus could be demonstrated at this point. An x-ray film of the thorax (taken in the recumbent posture, and too poor to be reproduced here) showed a fracture, not only of the left first rib but also of the second, third and fifth ribs on this side. These other fractures were painless, and their sites were marked by smooth, rounded elevations on the anterior surfaces of the ribs. These findings stimulated a repetition of the search for Bence-Jones protein and for roentgenological evidence of new growth, but nothing suggestive of malignancy was found. In the two succeeding months, pathological fractures of the fourth and sixth ribs on the left side, and of the second and fourth ribs on the right side occurred, but these caused him little if any inconvenience. Later, a small, fluctuating swelling appeared over the pathological fracture of the left sixth rib and was aspirated, a few minims of pus being obtained. This pus contained acid-fast bacilli on direct smear, and cultures subsequently verified the diagnosis of tuberculosis.

In the final month of his life he frequently lost consciousness for several minutes at a time. These attacks were associated with muscular twitching of the trunk, limbs and face, on both sides, and also with rapid shallow breathing, cyanosis and impalpable pulse,

leaving him with a tired feeling when he recovered consciousness. Further pathological fractures of ribs occurred, but neither they nor his spine occasioned him any pain. Towards the end he developed difficulty in swallowing, and had complete incontinence of urine and faeces. At no time was he troubled with headache, but sometimes he was irrational. On January 1, 1938, not quite two years after the onset of pain in his back, he died. A post-mortem examination was made by Dr. Noble Sharpe. It brought out the following points of interest.

Spine.—Typical tuberculous necrosis of the spine had destroyed the body of the ninth dorsal vertebra, except for a very small sequestrum lying free in an abscess filled with pus. The adjacent discs had become involved, and necrosis had extended backward into the spinal canal. Granulation tissue was closely adherent to the dura of the cord, but had not caused demonstrable pressure, nor had it invaded the cord.



Fig. 1.—April 3, 1937. Ninth dorsal vertebra almost completely destroyed.



Fig. 2.—September 29, 1937. Ninth dorsal vertebra completely destroyed.

Paravertebral abscess.—The abscess had spread widely outside the parietal pleura, chiefly on the right side and along the course of the ninth and tenth ribs. The parietal and visceral layers of the pleura were so densely adherent at this point that they could not be separated from each other.

Ribs.—Five ribs on the right side (Nos. 2, 4, 5, 6 and 7), and 9 on the left side (Nos. 1 to 7 and 10 and 11), showed a total of eighteen pathological fractures, some of which were surrounded by small abscesses, while others showed only rarefied bone. There was no predominating site of election for fracture, the distribution being quite irregular and not connected directly with the paravertebral abscess nor with the digitations of the serratus muscles.

Lungs.—There was no evidence of tuberculosis, but the visceral pleura covering the apex of the left lower lobe had been invaded by direct extension from the spinal abscess. There was no invasion of lung tissue.

Brain.—There was no evidence of miliary tuberculosis or of meningitis, but the volume of clear cerebrospinal fluid was considerably increased. There were no areas of hæmorrhage or softening.

Abdominal organs.—There was no enlargement of the liver and spleen, but throughout their substance were many tuberculous nodules, ranging in size up to 1 cm. in diameter. In the right suprarenal was one small tuberculous nodule.

Bone tuberculosis is hæmatogenous in origin, and may occur in association with the primary invasion when the body is non-allergic, or, later, as a complication of the dissemination stage of tuberculosis from the lymphatic pole of the primary complex. It is possible in most cases to determine the original site of the primary disease or of the subsequently infected regional lymph nodes even when there does not appear to be any tuberculosis of the reinfection type present. In the case reported above there was no healed or active primary or reinfection type

of lesion in the lungs demonstrable either by x-ray examination or by routine post-mortem sectioning. The peribronchial and mediastinal lymph nodes appeared normal, but on section one node from the posterior mediastinum showed several recent tubercles. These were probably the result of invasion subsequent to the spinal lesion, rather than evidence of a former pulmonary lesion. It was, therefore, not possible to demonstrate the presence of tuberculosis in the body prior to the onset of Pott's disease, and the question as to the course followed by the tubercle bacillus between the time it invaded the body and the time it became lodged in the spine remains unanswered. It is, however, recognized that a primary lesion must have been present in the body, though not discovered at post-mortem examination.

While it is common to find an occasional rib abscess as a minor complication of bone and joint tuberculosis it is difficult to account for the numerous tuberculous lesions scattered throughout the ribs in this case. Their wide distribution precludes the possibility of direct spread from the paravertebral abscess. No other lesions were discovered in the skeletal system, though some might have been expected in a heavy hæmatogenous infection. This gross but localized seeding cannot be explained readily on anatomical grounds. In view of the fact that the patient had only a very slight and inconstant cough, it hardly seems reasonable to suppose that the eighteen fractures were caused by coughing and subsequently became the seat of tuberculous lesions. Rib fractures caused by coughing almost invariably occur at the sites of origin of the serratus magnus muscle. In this case the fractures were irregular in their distribution.

It is possible that the aortic intima in the thoracic region may have had some small lesion

of tuberculosis which was not found at post-mortem examination. From this, tuberculous emboli may have broken off and lodged in the liver, spleen and ribs. If this were the case, it is strange that no other peripheral lesions were found. Altogether the story is an unusual one, and a satisfactory explanation has not yet been given.

SUMMARY

An unusual case of Pott's disease, showing rapid destruction of one entire vertebral body, has been reported. It was associated with the pathological fracture (due to tuberculosis) of fourteen ribs, but not with skeletal involvement elsewhere. There was a tuberculous pleurisy, arising from irritation of the parietal pleura by a tuberculous abscess of the spine, and not from irritation of the visceral pleura by intrapulmonary disease. There was a terminal miliary tuberculosis involving only the liver, spleen, suprarenal and the ribs already mentioned.

TWO CASES OF PRIMARY OSTEOMYELITIS OF THE PUBIC BONE

BY JOHN J. DINAN

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BEFORE actually starting this report I would like to say that while two cases of any ordinary condition would hardly constitute a series, osteomyelitis of the pubic bone is of comparatively rare occurrence, and after a survey of the available literature on the subject I decided that any information which could be submitted would be of value.

HISTORY AND PHYSICAL SIGNS

The points of importance which will be obtained from the history in a case of osteomyelitis of the pubes are as follows. (1) There may be a history of direct trauma to the pubes, *e.g.*, two cases occurred in cavalrymen who had been thrown against the pommel of their saddles, and one in a girl who had fallen astride the edge of a table. (2) There may be a history of indirect trauma to the lower leg, the knee, or even the foot. (3) There is often a history of previous infection, it may be on the skin in the sinuses or ears, in the respiratory, gastrointestinal or genitourinary tracts, or, as in two cases reported, a thrombophlebitis. On the other hand there may be no history of injury or in-

fection whatever. (4) There will always be a history of pain in the pubic region, and usually of pain down the inner side of the thigh and knee joint. This is referred pain along the distribution of the obturator nerve. (5) The patient will complain of having had difficulty and pain on walking or will have been unable to walk. (6) The usual history of local and general systemic manifestations can be elicited. These will include disability, malaise, fever, and, as a consequence of the latter, diaphoresis, headache and constipation. (7) If the condition has existed for a week or more some of these patients may complain of dysuria and frequency.

The physical examination will reveal all or most of the following findings. (1) The usual signs of toxicity and fever. (2) Temperature 99 to 105° and a pulse rate increased in proportion. (3) Localized maximum tenderness over the affected part of the pubes. (4) The patient will be seen to lie in the dorsal decubitus with one or both knees slightly flexed and the legs adducted. (5) Any movement, but particularly those of abduction and extension of the limb on the affected side, will cause pain in

the diseased pubic area. (6) In the female the labium majus on the side of the lesion will show some swelling and possibly a reddish discoloration as well. In the male the scrotum may be similarly involved. (7) A suprapubic collection of pus may be palpable, and this can easily be mistaken for a full bladder or a cystic pelvic tumour. (8) The red blood cells and hæmoglobin estimations are usually low, but may be normal. The white blood cells are invariably increased to a greater or lesser degree. The increase is in direct proportion to the acuteness of the infection and the patient's reaction to it, but in inverse proportion to the patient's age. This is not necessarily always true, but is a useful working rule.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis will consider fracture of the pelvis with damage to the urethra and extravasation of urine; traumatic puncture of the urethra (from causes other than fracture), with extravasation of urine, *e.g.*, from direct violence, instrumentation, urethral masturbation, etc.; acute urethritis and vaginitis; acute Bartholinitis; cellulitis in the pubic and perineal regions; separation of the symphysis pubis; fracture of the pubes with extraneous infection. There are probably some other conditions with which osteomyelitis might be confused, such as atypical pelvic inflammatory disease, but the above are the most common.

X-ray findings.—In the early case the x-ray picture will be negative. If the condition has been established for about two weeks, more or less, then bone necrosis will be evident. There are some points in regard to taking plates which are worth noting. Faeces or gas in the rectum or pelvic colon will obscure the picture. The lower bowel should therefore be well cleaned out. A direct antero-posterior view is not as good as an oblique one—the pelvis should be tilted, throwing the symphysis clear of the shadow of the sacrum. The tilt will of necessity be downwards and slightly laterally.

TREATMENT

The many different forms of therapy and operative technique which have been advocated for the cure of osteomyelitis are proof of the fact that no completely satisfactory method has yet been found. That some of them are superior to others there can be no doubt, but no one method is applicable to all types of cases.

There is fairly general agreement about the supportive measures which should be used in osteomyelitis. These are: (1) Complete rest, both locally for the affected part, and, generally, for the patient. (2) The toxæmia is combated with a high fluid intake, high carbohydrate and, in children, adequate protein diet. (3) For very septic cases intravenous fluids and repeated small blood transfusions. If septicæmia is present immunotransfusions are helpful. (4) Some type of staphylococcus antitoxin if the infecting agent is a staphylococcus. The antitoxin is most efficacious during the first 2 weeks, as subsequently the patient spontaneously develops an active immunity. (5) The use of a specific bacteriophage both locally and intravenously may be tried. (6) Sedatives and analgesics to promote sleep and rest from pain. (7) Concentrated forms of the various vitamins are probably of some use and should be given, particularly in the chronic cases. (8) In the healing stages calcium tends to speed up the process of repair somewhat.

It will be noted that nothing has been said about the extent of the initial operation. The reason for this is that this is something for which no definite rules can or should be laid down.

Within the past three or four years the surgical treatment has been more conservative than was formerly the case. It is no longer considered a *faux pas* to leave diagnosed cases for 24 to 48 hours or longer while attempts are made to improve their condition and build up their resistance before subjecting them to the always more or less shocking operative procedures. At actual operation the tendency is to do as little as possible. It is becoming an increasing rarity to see huge areas of uninvolved bone removed. The keynote of this relatively new school seems to be "provide adequate drainage when and if it is necessary".

The "if" applies particularly to infants and to cases in which a septicæmia completely overshadows the local condition. In these types procedures which produce a minimum of trauma are indicated. Sometimes to do no more than aspirate pus through a needle is sufficient. This conservative policy is a decided step forward, but, even so, one has only to read the mortality rates and see some of the disfiguring and disabling end-results of any type of treatment to realize that we have by no means reached a therapeutic pinnacle.

I am convinced that when individual immunological reactions to different strains of staphylococci, streptococci, and other organisms, can be accurately determined, then our whole attitude towards the treatment of osteomyelitis will be changed considerably. Some very useful work along these lines is being done, but much remains to be done.

But conservative tactics cannot be applied in osteomyelitis of the pubes or other pelvic bones. In this one particular location it is safer to do too much than too little. True, there is no particular hurry about operating. In fact few of these cases will be seen in the very early stages so that an additional day or two can make but little difference. However when an operation is performed it should be an adequate one. In this area perfect drainage will rarely be attained, and if the incisions are not sufficiently large or properly placed the drainage through them will be very inadequate. As far back as 1906 Von Bergmann suggested that the extent of the operation should be in direct proportion to the duration of the lesion. This is a general statement which probably was not intended as an iron-bound rule. At the present time x-ray evidence and the actual operative findings provide a somewhat better basis for determining the extent of the resection.

Before proceeding further I would like to present the following table of 34 cases of primary osteomyelitis of the pubes. It was not possible to obtain the literature on all the cases reported, but these represent the majority and provide a good basis for the determination of the best course of treatment.

If it is permissible to base figures on a series of 34 cases, they are as follows.

26 cases—8 fatalities—mortality approximately 23 per cent.	
8 medically treated cases	} 9—5 fatalities.
1 case treated by needle puncture	
Mortality rate 55 per cent (approximately).	
25 cases surgically treated—3 fatalities.	
Mortality 12 per cent.	

It is obvious that as statistics these figures and percentages are of very little value, but if they can be accepted in a broad way as offering some proof that radical measures are necessary in pelvic osteomyelitis then they have served their purpose.

OPERATIVE TECHNIQUE

The exact operative technique should only be determined after the exploratory incision and

digital examination of the bone have determined the extent of the lesion. Granting that the infection is an early primary one in the os pubis and that the patient's condition is good, it is thought that the best results will be obtained by immediate operation.

A transverse incision should be made through the skin and muscular aponeurosis just above and slightly lateral to the symphysis pubis. This exposes the transversalis fascia which is separated from the posterior aspect of the rectus insertion by a definite fat-filled space which may or may not contain pus. The fascia is incised and the prevesical space is opened. This will contain pus of varying amounts depending on the stage of the disease. Digital examination will now enable one to determine the extent of the bony lesion.

If the disease is confined to the upper part of the body and the pubic spine or the superior border of the horizontal ramus resection of the diseased bone and drainage through the suprapubic incision will probably be sufficient. If, however, the involvement is fairly extensive and takes in the lower part of the body and the descending ramus, the resection will of necessity be more extensive and additional incisions will have to be made.

The second incision should be situated just outside the lateral border of the labium majus in the female and in a corresponding position in the male. In the event that both pubic bones are extensively involved a similar paralabial incision should be made on the other side.

The suprapubic incision should be the initial one in all cases because, first, it provides the best access for exploration and resection, and, secondly, it is the least mutilating and safest. The secondary incisions are usually necessary, and there should be no hesitation about making them if the lesion is at all extensive. They provide better drainage, make radical resections easier, and prevent to some extent the tracking of pus down into the perineal region and along the adductor group of muscles.

In making the paralabial incision in the female the vaginal plexus will be cut into; these vessels will have to be tied off as they are encountered, because they bleed very freely. By keeping to the lateral side of the body of the pubes and descending ramus any danger to the urethra will be avoided. In the male the incision must not be started too high or the spermatic cord may be severed.

TABLE
REPORTED CASES OF PRIMARY OSTEOMYELITIS OF PUBES 1883 TO 1937

	Age	Sex	Duration of condition	Organism	Treatment	Result	Remarks	Operative or autopsy findings
Gouillard	9 days	F	.....	.....	Medical (1).....	Dead-20 days	.....	Osteomyelitis of left pubic bone.
Gouillard	20 yrs.	M	.....	.....	Aspiration of pus.....	Dead-40 days	.....	Osteomyelitis of left pubic bone and left hip.
Secheyron	11 yrs.	M	.....	.....	Medical (2).....	Dead-25 days	.....	Osteomyelitis of left pubic bone and pericarditis.
Secheyron	22 yrs.	M	5 days	.....	Medical (3).....	Dead-15 days	.....	Osteomyelitis of left pubic bone and pneumonia.
Colzi	.....	?	Chronic	Staph.	Resection of horizontal and descending rami.	Cured	.....	.....
Dumoutin	13 yrs.	M	6 months	.....	Immobilization (4)....	Cured	Family history of tuberculosis	.....
Kirchner	21 yrs.	M	10 days	Staph.	Resection of pubes.....	Cured	.....	Main lesion in right side of body of pubes.
Koreuski	9 yrs.	M	14 days	.....	Resection of left pubes.	Cured	.....	Extensive lesion in left body and both rami.
Bergmann	23 yrs.	M	5 days	Staph.	Resection of pubic spine and left ramus.	Cured	Persistent fistula.	.....
Bergmann	22 yrs.	M	Recent	Staph.	Resection of right horizontal ramus and hip joint.	.....	Fixation of right hip.	.....
Bergmann	25 yrs.	M	3 weeks	Staph.	Resection of left pubes.	Died	Septicæmia.	.....
Thomschke	23 yrs.	M	Recent	Staph.	Resection of pubes.....	Died	.....	Extension of disease throughout pelvis.
Thomschke	25 yrs.	M	Recent	Staph.	Partial resection.....	Cured	.....	.....
Thomschke	30 yrs.	M	Recent	Staph.	Partial resection.....	Cured	.....	.....
Klemm	10 yrs.	M	3 weeks	Strep.	Incision and curettage..	Cured	.....	.....
Klemm	.....	?	Recent	Staph.	Incision and curettage..	Cured	.....	.....
Plau	6 yrs.	M	Chronic	.....	Incision and drainage..	Cured	.....	.....
Keyes	24 yrs.	F	Recent	Staph.	Incision and curettage..	Cured	Rarefaction near pubic spine.	.....
Ciaccia	6 yrs.	M	Recent	Staph.	Incision and curettage..	Cured	.....	.....
Levi	13 yrs.	M	5 days	Staph.	Medical (5).....	Dead	.....	.....
Delahaye	11 yrs.	M	Chronic	Staph.	Extirpation of fistula (6)	Cured	.....	No treatment of original lesion; spontaneous cure.
Zaffagini	30 yrs.	F	30 days	Staph.	Incision and curettage..	Cured	.....	Had a history of pelvic osteomyelitis at age of 18 years.
Divings	7 yrs.	M	Recent	Staph.	Medical (7).....	Cured	.....	.....
McWhorthers	.....	M	Recent	Staph.	Incision and curettage..	Cured	.....	.....
Zaffagini	9 yrs.	M	Recent	Staph.	Incision and curettage..	Cured	.....	.....
Ingelrans	15 yrs.	M	15 days	Staph. Aut.	Incision and drainage..	Cured	8 months in hospital.	.....
Ingelrans	43 yrs.	M	Chronic	Staph. Aut.	Repeated operations...	Cured	3½ years in hospital.	.....
Iesu	20 yrs.	M	Recent	Staph. Alb.	Incision and curettage..	Cured	.....	.....
Iesu	6 yrs.	F	10 days	Staph. Alb.	Partial resection.....	Cured	.....	.....
Iesu	50 yrs.	F	Recent	Staph. Alb.	Partial resection.....	Cured	.....	.....
Borsotti	18 yrs.	M	Recent	Staph.	Partial resection.....	Cured	.....	.....
Wilenski	10 yrs.	M	Recent	Staph.	Medical (8).....	Cured	.....	.....
Hingston	16 yrs.	F	2 weeks	Staph.	Repeated operations...	Dead	.....	Condition spread throughout bony pelvis.
Hingston	34 yrs.	F	1 week	.....	Incision and curettage..	Cured	.....	.....

25 males
7 females
2 ?

Total 34 cases

Medical treatment 8 4 C. - 4 D. Mortality 50 per cent.
Aspirated cases 1 0 C. - 1 D.
Surgical treatment 25 22 C. - 3 D. Mortality 12 per cent.

Total number of cases 26 C. - 8 D. Mortality 23 per cent (approx.).

Having cut through the skin and subcutaneous tissues the origins of the adductor group of muscles will be seen. These should be divided close to the bone even if it (the bone) is not being resected; otherwise the drainage will be unsatisfactory. The medial part of the obturator externus is also cut away and the obturator membrane is now exposed. A blunt probe is pushed through this and the underlying obturator internus. The opening is then enlarged with a scissors or scalpel until two fingers can be pushed into it. Through and through drainage between the suprapubic and paralabial incision or incisions is now established.

The primary incision above the pubes needs very little explanation. It is made parallel to the superior border of the pubic bone. The situation of the round ligaments is well known and can be avoided if necessary—the same statement applies to the spermatic cords. The insertion of the rectus abdominis will be partially or completely cut through and the transversalis fascia divided. The bladder is usually found to be displaced upwards and backwards by an accumulation of pus, although this does not warrant or justify any blind stabbing.

The operation having been completed, the whole cavity should be loosely packed with well lubricated gauze. This is removed at the end of 72 hours. Good analgesia, or possibly general anaesthesia, will be necessary. A broad-flanged rubber tube is placed in the suprapubic incision and soft rubber tubes or cigarette drains in the paralabial incisions. Irrigations of the cavity can now be instituted as often as is considered necessary, and while they can be carried out without disturbing the patient to any great extent two or three a day should suffice. There is no point in specifying a particular solution for this purpose; any dilute, non-irritating, antiseptic, so long as it is warm and used in copious amounts, will do.

A problem for which no completely satisfactory solution is apparent now presents itself. That is whether or not the patient should be placed in a plaster spica. It is difficult to get immobilization even with a cast, and yet this is very much to be desired. Placing the patient on a fracture bed without a cast has certain advantages, though, admittedly, it does not provide much immobility. (1) It makes the necessary nursing and dressings easier, as the mattress can be lowered, permitting the patient to use the bed pan and allowing draining of

irrigations to run through without moving the patient. (2) It makes aseptic technique in doing dressings more of a possibility. (3) It facilitates the locating and opening of any abscess which may develop. (4) It militates against the occurrence of decubitus ulcers, as the patient is cleaner and more comfortable than if in a cast. These ulcers will constitute a difficult problem in chronic cases; painstaking nursing care and adequate padding of bony prominences will be necessary if they are to be avoided.

As against all these the plaster spica has the one tremendous advantage of providing immobility. If applied it should be a complete cast extending up to the costal margin in front and up to the 9th or 10th thoracic spine behind. The leg on the affected side should be included right down to the foot and should be maintained in slight adduction or a neutral position and with the hip and knee slightly flexed. The leg on the other side is to be included as far as the knee and it must be abducted to provide space for dressings, etc., in the groin.

Even with the patient in a cast some type of fracture bed will be found to provide better facilities for nursing and dressing with a minimum of disturbance.

The general treatment of any case should be as forceful and drastic as the local operative procedure—every means which can be used to build up the patient's resistance and specific immunity should be taken advantage of. The statistics, such as they are, show a mortality rate of about 23 per cent. Granted that if only the recent cases are considered the rate is much lower, but it is still high enough to make the prognosis a very grave one.

CASE 1

A white female, aged 16, was admitted in November, 1936, to St. Mary's Hospital, Montreal.

Complaints.—Pain in the pubic region; malaise and disability; pain in the left knee; dysuria for 4 days; frequency of urination for 4 days. There had been an injury to the left pubes 14 days previous to admission, when the patient fell astride the corner of a table. Pain in the pubic region had been felt since that time. She was confined to bed since three days after the accident, as she was unable to walk owing to the pain when any movement was attempted.

Previous history.—Nothing important.

Positive findings from physical examination.—A well nourished, well developed young white female, lying in the dorsal decubitus with the left leg slightly flexed and adducted. Pulse rate 100; temperature 102°.

The left labium majus and surrounding area were swollen and showed a dusky reddish discoloration. The tissues were soft, not oedematous, and appeared to be involved in an acute inflammatory process. There was no superficial tenderness, but on firm pressure the

patient complained of pain all about the pubic area, with a point of maximum tenderness just over the superior aspect of the left pubic spine. The swelling extended from the top of the pubes to the perineum and involved the immediately contiguous part of the thigh. Bartholinian glands.—Not enlarged or tender. No vaginal discharge or vaginitis. Hymen intact. Urethra normal.

The left leg was slightly flexed and adducted. Active movements were very limited, obviously painful and unwillingly performed. All passive movements of left leg caused pain in the pubic area and the knee. Maximum pain was elicited by attempted extension and abduction. When the upper leg was steadied in a position of flexion and adduction movements of the knee were quite painless. The right leg was freely and painlessly movable except when forced abduction was attempted. This movement caused pain in the pubic area. Other findings noted were: small healed paronychia in the left index finger; a leucocyte count of 12,000; polymorphonuclears comprised 76 per cent; red blood cells 4,800,000; hgb. 88 per cent; urinalysis was negative.

Provisional diagnoses.—(1) Fracture of the left pubic ramus with tearing of urethra and extravasation of urine; (2) osteomyelitis of the pubic bone.

On genito-urinary consultation no lesion could be found in the lower urinary tract and the opinion was

that the condition was not due to rupture of the urethra or any extravasation.

X-ray.—On the morning after admission. No fracture or abnormality of the pubes or other pelvic bones was detected.

A blood culture taken on the day after admission gave no growth in 72 hours.

Treatment.—No definite diagnosis having been established, the patient was merely kept under observation. Continuous hot fomentations were applied to the pubic and paralabial regions. There was slight diminution of pain, but the temperature remained elevated, the pulse rapid, and the patient's general condition at the end of a week was definitely worse.

A second x-ray (Fig. 1) was taken on the seventh day after admission and evidences of bone necrosis on the left side of body of the pubes were found.

First operation.—Under gas oxygen anaesthesia a suprapubic incision was made. A large amount of thick yellow pus was evacuated from the prevesical space, several loose pieces of necrotic bone were removed from the left side of the body of the pubes and the proximal part of the left horizontal ramus. A large rubber tube was placed *in situ* and the cavity was packed lightly with acriflavine gauze, the incision being left wide open. On return to the ward the patient was

Fig. 1*

Fig. 2



Fig. 3

Fig. 4

Fig. 1. Case 1.—Second x-ray showing beginning of osteomyelitis in the left side of the body of the pubic bone. Fig. 2. Case 1.—Showing extensive involvement of the left side of the pelvis and left hip joint; some involvement of right side as well. Fig. 3. Case 2.—Initial x-ray. Fig. 4. Case 2.—Final x-ray showing satisfactory end-results.

* X-ray plate of Fig. 1 was reversed in photographing.

placed in a fracture bed and a continuous intravenous of 5 per cent glucose saline was started and continued for 72 hours. Recovery from the operation was uneventful.

Three days after operation.—The packing was removed and bidaily irrigations with Dakin's solution were started. Report on the culture of pus taken at operation showed the infective organism to be *Staph. aureus*.

Fourth day after operation.—Blood was taken for culture; a blood transfusion of 250 c.c. was given.

Seventh day after operation.—Report of blood culture was negative; a blood transfusion of 250 c.c. was given.

For three weeks she was given bidaily intravenous glucose saline, 1,000 c.c., and biweekly transfusions of 150 c.c. Her condition became steadily worse and all the evidence pointed to an extension of the lesion. This was confirmed by an x-ray (Fig. 2). The report was that the entire left side of the body of the pubes and the major part of both rami were now involved.

Second operation.—Digital exploration through the suprapubic incision revealed that the extension was more marked than had been demonstrated by x-ray. A left paralabial incision was made, the major part of the left body and both rami was resected. Several pockets of pus in the perineal region were opened by blunt dissection. The cavity was again firmly packed, drains were placed in both incisions, and following blood transfusion the patient was returned to the ward.

On the 2nd day after operation the patient had a remission of temperature and for four days seemed definitely better. The temperature again rose on the 6th day and her condition grew steadily worse.

Blood culture 1 week after operation was negative.

The patient survived for seven months, and during this time developed numerous abscesses in both legs. These were opened as soon as detected.

Late in the 5th month of the disease a radical resection of the entire left side of the pelvis and left leg was considered, but it was finally decided that she would not survive such a procedure. As a compromise a rapid operation was done, at which the remainder of the pubic bone, the left ischium and part of the left ilium were resected.

The operation was fairly well borne, but she at once resumed her downward course. In addition to numerous blood transfusions and glucose saline infusions she was given viosterol by mouth. Her ordinary high fluid, high carbohydrate diet was supplemented with egg-nogs and rich meat broths. During the last 2 months she had 5 units of insulin b.i.d. with her intravenous solution. She died in May, 1937. Unfortunately permission for an autopsy could not be obtained.

Looking back on this case our own criticism is that possibly we did not operate soon enough. A fairly wide resection should have been done at the first operation and a still more radical one at the second. There is a possibility that staphylococcus antitoxin might have been of use during the first week.

CASE 2

A white female, aged 34, was admitted to St. Mary's Hospital, Montreal, in March, 1937.

The history obtained from patient on admission was that she had been five months pregnant and had aborted two weeks previously. Since the abortion she had been confined to bed with chills and a high temperature.

The treatment she received in the Department of Gynaecology is immaterial so far as this paper is concerned. Sufficient to say that there was no operative interference of any kind and that after a very stormy course the patient recovered from an extensive pelvic cellulitis and thrombophlebitis. She was afebrile for 2 weeks and then had a recurrence of fever. This was considered as being due to an exacerbation of the pelvic condition until eight days after the onset, when she began to complain of pain in the pubic region. A surgical consultation was asked for and the suggested diagnosis of osteomyelitis of the pubic bone was confirmed by the discovery of localized tenderness of the right side of the body of pubic bone, a cystic suprapubic tumour, and by x-ray evidence of a small area of rarefaction in the superior part of the body of the right pubes (Fig. 3).

Immediate operation.—Through a suprapubic incision the superior portion of the right body of the pubic bone was resected. The area was packed and drained as had been done in the first case. Patient staged an uneventful recovery and was afebrile 5 days later. The subsequent treatment was much the same as for Case 1, except that no intravenous medication was considered necessary. Healing was rapid. The pubes was completely united and the patient was ambulatory in three months' time.

The initial and final x-ray, the latter (Fig. 4) taken just before discharge, show the course of the case more briefly than words.

The operation in this case was more radical than the same operation in the first case. It was not considered necessary to make paralabial incisions, as only the superior part of the right body was involved.

The subsequent course of the case was evidence of the fact that the operative interference was timely and adequate. Other points of interest about this case are that a blood culture taken two days after the first admission was reported negative, and a second, taken three days after the second onset of fever was negative. It is probable however that the patient had a bacteriæmia at some time prior to the development of the osteomyelitis. Another rather obvious conclusion is that she must have developed a rather high immunity during the course of her pelvic condition, which was evidently not sufficient to prevent the bone infection, but was nevertheless enough to enable her to cope with it, once incision and resection had established good drainage. It was this latter observation which gave rise to the statement that individual immunological reactions are a very important factor in determining the treatment of any case of osteomyelitis.

The cases reported were admitted to the wards of St. Mary's Hospital, Montreal, during my term as Resident in Surgery. I am much indebted to Dr. D. A. Hingston, Chief Surgeon of the hospital, for permitting me to publish this report, and for his and Dr. E. Mullally's aid and constructive criticism.

THE PRODUCTION OF HYPERTENSION BY THE PREVENTION OF KIDNEY HYPERTROPHY

(PRELIMINARY REPORT)

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SEVERAL recent observations have suggested to us that inadequate emphasis has been placed on the rôle of the work required of the ischaemic kidney in the production of hypertension by constriction of the renal artery.

Goldblatt¹ has demonstrated that constriction of one renal artery causes a transient rise in blood pressure which is rendered permanent by removal of the contralateral kidney. This has been shown conclusively to be a humoral mechanism.² The fact that the normal kidney must be removed in order to cause permanent hypertension suggests either that the normal kidney excretes or destroys the renal pressor substance or that the increased work imposed on the ischaemic kidney results in an increased production of the pressor substance. Possibly hypertrophy of the normal kidney reapporitions the work so that after some time there is no longer a disproportion between the blood supply and function of the kidney whose artery has been constricted. These two possibilities are not, of course, mutually exclusive. In favour of the former is the demonstration by Fasciolo, Housay and Taquini³ that a pressor effect can be shown by grafting an ischaemic kidney into the neck of a test dog, only if the dog previously has been nephrectomized. These workers have other evidence to support this view. Conforming with the second possibility is the production by Dill and Ericson⁴ of eclampsia in pregnant bitches by mild constriction of the renal artery. The recent demonstration by Drury⁵ of the production of hypertension in growing rabbits by means of a loop which kept the blood supply to the kidney from increasing as the work increased is another example of the development of a relative ischaemia.

It occurred to one of us (N.B.T.) that possibly the release of the renal pressor substance was a physiological response to a disproportion between work required of the kidney and its available blood supply. This suggests many

lines of investigation. If this concept is true it should be possible to produce hypertension by preventing the hypertrophy of a kidney which occurs following removal of the opposite kidney. The following experiment on dogs was conducted on these considerations.

Under nembutal anaesthesia the kidney was exposed through a lumbar incision. The peritoneal cavity was invariably opened, as it was found impossible to mobilize the kidney for application of the cast without the damage occurring. The kidney was delivered into the wound and enveloped with strips of gauze which were then soaked with collodion and allowed to harden, a layer at a time, *in situ*.^{*} After hardening, a window $\frac{1}{2}$ to $\frac{1}{4}$ inch square was cut in the cast opposite to the hilus. Care was taken that the hilus was free and no pressure was applied to artery, vein or ureter.

The kidney was returned to its bed and the wound closed in layers. Blood pressure readings were taken for from 5 to 10 days prior to operation to establish the normal level and at regular intervals subsequently. All readings were taken with a mercury manometer by femoral arterial puncture. The contralateral kidney was removed at a second operation within 5 to 10 days of the first. In a few dogs the window was omitted at the first operation, and in a few, casts with or without windows were applied to both kidneys at one sitting.

RESULTS

The animals are divided into two groups, according to the procedure followed.

Group I. Enclosure of one kidney in a cast with or without a window, followed by contralateral nephrectomy at a second operation.—In more than half these animals enclosing one

^{*} This method for preventing renal hypertrophy was suggested by experiments carried out by Soskin and Saphir⁶ some years ago for another purpose.

kidney in a cast was followed by no appreciable change in blood pressure. If a rise occurred following the first operation the animal was discarded from the group. In all the remaining animals removal of the opposite kidney was followed by a prompt and pronounced rise in blood pressure, usually of 30 mm. or more in the first 24 hours. This rise progressed for about a week, if the animal survived. The elevation of blood pressure has been maintained in all animals for as long as they have been followed, the longest being 8 weeks. In this animal death occurred from a massive hæmorrhage from the bowel, eight weeks after the second operation. At post-mortem there were small submucosal hæmorrhages throughout the gastrointestinal tract and tiny petechiæ in the pancreas and liver. His record is shown graphically in Chart 1.

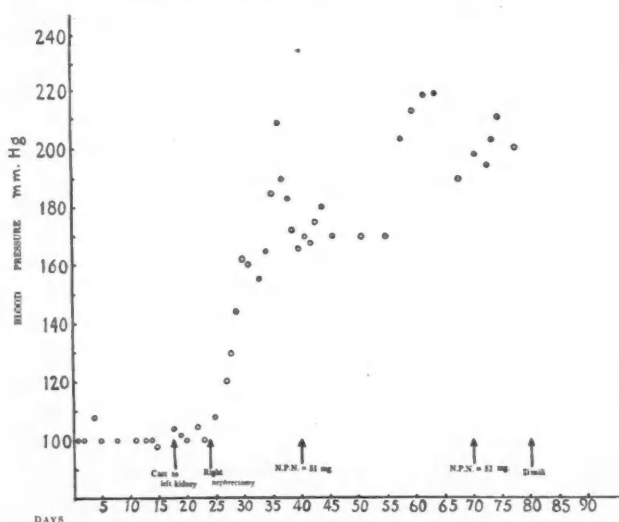


Chart 1.—Male Beagle; 20 kilo. Record of blood pressure following application of cast to left kidney and contralateral nephrectomy.

The results of the first operation are tabulated in Table I.

TABLE I.
CAST TO RIGHT KIDNEY.

Rise in blood pressure		No rise	
3		2	
Window	No window	Window	No window
3	0	1	1

CAST TO LEFT KIDNEY

Rise in blood pressure		No rise	
1		4	
Window	No window	Window	No window
1	0	1	3

The 6 dogs which showed no rise following the first operation were after a week submitted to contralateral nephrectomy. All showed marked rises in blood pressure. The animal of Chart 1 was one of them. Two still survive after three and seven weeks with elevated pressures and normal non-protein nitrogens. One died of pneumonia three days after operation, showing a rise of 35 mm. when moribund. One dog, without a window in his cast, died in uræmia and hypertension after six days and showed many petechiæ in the gastrointestinal tract. The sixth, which was a placid and amiable dog, was found snarling and snapping in his cage on the second day after the operation. He had a subconjunctival and a retinal hæmorrhage on the right side. He became very weak and was killed the following day, showing no rise in non-protein nitrogen and no gross pathological change to account for his apparently moribund state. In the gross his brain was normal.

Group II. Casts to both kidneys at one operation, with or without windows.—Three animals have been subjected to this procedure. All died in uræmia in 4 days, with no rise in blood pressure.

DISCUSSION

The results outlined above show that chronic hypertension occurs when renal hypertrophy which ordinarily follows unilateral nephrectomy is prevented. The mechanism by which hypertension occurs in these cases is not clear, though it appears to be of humoral rather than of reflex origin. It seems most unlikely that interference with structures at the hilus can play a part. Any kink in the artery must have occurred at the first operation and would probably have been followed by a transient rise in blood pressure.

Why hypertension occurs in some dogs where only one kidney is enclosed in a cast is equally difficult to explain. Possibly the weight of the cast may cause some kinking of the vessels. It has occurred more frequently on the right side. The fact that the renal artery on this side has to pass behind the vena cava may be significant.

Kinking of the right renal artery over the vena cava was observed in one dog, which showed a rise in blood pressure after the first operation, and died in uræmia following removal of the left kidney. Casts were applied to the right kidneys of four dogs and have then been stitched to the posterior body wall. These ani-

imals are not included in Group I. None of them has shown a rise in pressure. Their left kidneys have not yet been removed.

CONCLUSION

The application of a cast to one kidney followed by extirpation of the opposite one is a reliable method of producing a pronounced and rapid rise in blood pressure. The hypertension appears to be permanent. Whether or not the

prevention of renal hypertrophy is the provocative factor is a question which can be answered only by further investigation.

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THE TREATMENT OF PNEUMOCOCCIC PNEUMONIA WITH
SULFAPYRIDINE (DAGENAN)*

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SINCE the original reports of Whitby¹ and Evans and Gaisford,² a number of papers^{3 to 6} appearing from widely separated sources have indicated favourable results from the use of sulfapyridine (dagenan, M and B 693) in the treatment of pneumococci infections. It is the purpose of this paper to report 105 cases of primary pneumococci pneumonia treated with sulfapyridine, and to review certain observations made in connection with the use of this drug.

MATERIAL

The series includes only those cases which showed definite clinical and radiological evidence of pneumonia, and from which pneumococci belonging to one of the thirty-two serological types were isolated from the sputum or blood, or by lung puncture. Blood cultures, blood counts and urinalyses were done as a routine, and determinations of the sulfapyridine content of the blood with spectroscopic examination for methæmoglobin and sulphhæmoglobin were done in the majority of cases. Sulfapyridine therapy was begun only after a positive etiological diagnosis had been established and blood cultures made.

At the commencement of this study it was decided that all patients admitted with pneumonia would be treated with sulfapyridine alone for a period of 12 to 24 hours and, if at the end of this period, there was not definite evidence of clinical improvement or if the patient's condition on entry was such that recovery

seemed unlikely without specific serum, specific antipneumococci rabbit serum was given in addition to drug therapy. Only 7 patients received serum in addition to sulfapyridine. Three of these died, being practically moribund on admission. No attempt has been made to compare combined therapy with the use of either serum or sulfapyridine alone.

RESULTS

In Table I the cases are classified according to type and the presence or absence of bacteriæmia. The mortality rate for each of these groups and for the entire series is shown. In Tables II, III and IV the series has been tabulated according to age distribution, duration of

TABLE I.

Type	Non-Bacteriæmic			Bacteriæmic			Total		
	No. of cases	Mortality		No. of cases	Mortality		No. of cases	Mortality	
		Cases	Per-centage		Cases	Per-centage		Cases	Per-centage
1	22	2	9.0	3	..	...	25	2	8.0
2	13	..	...	..	..	...	13	..	...
3	21	2	9.5	5	4	80.0	26	6	23.0
4	3	..	...	..	..	...	3	..	...
5	4	..	...	..	..	...	4	..	...
6	1	..	...	..	..	...	1	..	...
7	9	..	...	..	..	...	9	..	...
8	9	1	11.0	..	..	...	9	1	11.0
10	1	1	100.0	..	..	...	1	1	100.0
12	2	..	...	..	..	...	2	..	...
17	2	..	...	..	..	...	2	..	...
20	2	..	...	..	..	...	2	..	...
22	1	..	...	..	..	...	1	..	...
24	1	..	...	..	..	...	1	..	...
28	1	..	...	..	..	...	1	..	...
29	1	..	...	1	..	...	2	..	...
32	3	..	...	..	..	...	3	..	...
Total	96	6	6.25	9	4	44.0	105	10	9.5

* It will be recalled that sulfapyridine, dagenan, and M and B 693 are names for exactly the same drug. From the Medical Service of the Montreal General Hospital.

disease on admission to hospital and the extent of the pulmonary consolidation. Comparison of these figures with a previous series studied

TABLE II.

Age	Number of cases	Fatal cases
10-19.....	6	0
20-29.....	21	1
30-39.....	26	1
40-49.....	16	2
50-59.....	20	3
60-69.....	9	2
70-79.....	7	1
	105	10

In 53 cases under 40 the mortality was 3.8 per cent, while in 52 cases over 40 the mortality was 15.4 per cent.

TABLE III.

DAY OF DISEASE ON ADMISSION

Day of disease	Number of cases	Fatal cases
1st.....	7	0
2nd.....	28	1
3rd.....	19	0
4th.....	16	2
5th.....	15	3
6th.....	9	1
7th.....	6	2
8th.....	2	1
Unknown.....	3	0
	105	10

In 54 cases treated before the 4th day the mortality was 1.8 per cent, while in 51 cases treated on the 4th day or after the mortality was 17.6 per cent.

in this hospital⁹ shows a remarkable similarity in regard to types encountered, bacteriæmia and the class of patient, and it would seem reasonable to conclude that pneumonia, as it occurred in Montreal during the winter of 1938-39, was of average severity. Types I, II and III were the causative organism in 61 per cent of the series, while 86 per cent belonged to Types I to VIII. The incidence of bacteriæmia was con-

TABLE IV.

NUMBER OF LOBES INVOLVED

	Number of cases	Fatal cases	Mortality percentage
1 lobe.....	86	4	4.6
2 lobes.....	13	2	15.4
3 lobes or more	4	4	100.0
Atypical.....	2	..	...

siderably lower (8.5 per cent) than has been reported by some investigators.^{4, 8} There were 10 deaths among the 105 cases, a mortality rate of 9.5 per cent. The important clinical data concerning these cases are summarized in Table V. Six of the deaths were due to Type III pneumonia, all of these cases being admitted late in the disease, 4 with heavy bacteriæmia and 3 being considered moribund on admission; another patient died after nine days of normal temperature, from progressive heart failure precipitated by the pneumonia, and autopsy revealed the pneumonia to be almost completely resolved.

TABLE V.

FATALITIES

Case	Type	Age	Day of disease	Bacteræmia	Involving	Time till death	Remarks
1	III	62	8	+++	LUL	10 hours	Moribund on entry.
2	III	55	7	+++	RUL	12 hours	Moribund on entry.
					RML		Empyema.
					RLL		
3	III	56	5	+++	RLL	48 hours	Alcoholic with D.T's.
					RML		
4	III	50	5	++	RML	24 hours	Moribund on entry.
					RLL		
					LLL		
5	III	74	4	....	RUL	12 days	Died after 9 days of normal temperature, of progressive heart failure.
					LLL		
6	III	38	6	....	RLL	24 hours	Developed pneumonia 24 hours after severe CO poisoning.
					LUL		Moribund on entry.
					LLL		Chronic emphysema.
7	I	48	5	....	RLL	36 hours	
					RML		
					LLL		
8	I	24	2	....	RLL	16 hours	Sudden fatal vascular collapse. Cause unknown. Autopsy not obtained.
9	VIII	63	4	....	LLL	48 hours	Arteriosclerotic heart disease. Temperature dropped but patient died of cardiac failure.
10	X	44	7	....	LUL	7 weeks	Died of lung abscess and nephritis with renal insufficiency.
					LLL		

Excluding Type III from the series, the mortality rate for the remaining types is 5.2 per cent. Patient 10 died seven weeks after the onset of his illness as the result of a large lung abscess, complicated by nephritis and renal insufficiency. With one exception, the prognosis in all of the fatal cases was extremely poor from the time of admission.

COMPLICATIONS

The complications which occurred are listed in Table VI. Massive serous effusion, requiring aspiration, occurred in 12 cases, all of which were absorbed promptly. In one case Type I pneumococcus was isolated from the pleural fluid which later became sterile and cleared spontaneously. Frank empyema occurred in 3 cases; one of which was discovered at autopsy in a patient who died twelve hours after admission, while the other two recovered after surgical drainage. There were two cases of post-pneumonic lung abscess with one fatality. Acute otitis media and acute thrombophlebitis were each encountered once. Although definite conclusions as to the relative occurrence of complications cannot be based on a series of this size, the incidence is lower than was observed in previous years.⁹

TABLE VI.
COMPLICATIONS

1. Sterile pleural effusion.....	12 cases
2. Infected pleural effusion, becoming sterile and clearing after repeated aspiration.....	1 case
3. Empyema.....	3 cases
(a) One patient died within 24 hours of admission on 8th day of disease.	
(b) Two required surgical drainage and recovered.	
4. Lung abscess.....	2 cases, 1 fatal
5. Pneumococcal otitis media.....	1 case
6. Thrombophlebitis.....	1 case

DOSAGE

In this study the drug was administered entirely by mouth. In general, the dosage now employed is that originally recommended by Whitby,¹⁰ i.e., 2 g. (gr. 30) as an initial dose, 2 g. two hours later and continuing with 1 g. every four hours. This treatment was continued until the temperature had approached normal limits for 24 hours, after which the dose was reduced to 1 g. every six hours for an additional 24 hours, then to 1 g. three times a day for 24 hours. With this dosage the average case received a total of 20 to 25 g. of sulfapyridine.

At first, in an effort to maintain the blood level at about 10 mg. per cent, up to 12 g. were administered in the first 24 hours, but it soon became evident that such large doses could not be tolerated by the great majority of patients because of severe nausea and vomiting, and subsequent experience with smaller dosage has shown that this yields equally satisfactory results.

The total dose showed considerable variation in individual cases. A review of all the cases which recovered showed that those caused by Types I, II and III, in general received the drug for a longer period than cases due to the higher types, the former receiving the drug for an average period of 4.5 days, and the latter for an average period of 3 days. Recurrence of the disease, after an initial response, occurred in 4 cases, all of which had received the drug for less than 48 hours, and all being due to Types I, II and III.

It would appear that the dose employed is sufficient to produce an adequate therapeutic response, and if continued for a period of 3 to 5 days recurrence of the pneumonia is most unlikely. Cases in which treatment was commenced after the fourth day, if they responded rapidly, were found to require a smaller total dose than those treated earlier in the disease, a dose of 12 to 20 g. over a period of 48 to 72 hours usually sufficing.

The blood level of sulfapyridine was determined in 75 cases, in most instances at daily intervals. Wide variations in total amount and in the relative proportions of free and acetylated sulfapyridine were observed. The minimum level obtained was 3 mg. of free sulfapyridine and only 10 per cent of the cases failed to reach a level of 4 mg. within 48 hours. The highest level observed was 17.1 mg. in the free state following five days of treatment. In the great majority of cases the levels ranged from 4 to 8 mg. per cent of the free drug.

RESPONSE TO TREATMENT

The earliest and most dramatic indication of response to sulfapyridine therapy was a drop in temperature. With few exceptions, the fall commenced within 12 to 18 hours after the initial dose and approached normal in 24 to 36 hours. This response came to be regarded as such a regular occurrence in non-bacteriæmic cases that if it did not appear a previously unrecognized empyema or other complication was suspected.

Cases of bacteriæmia which recovered responded in essentially the same manner, except that the drop in temperature was more gradual. Fifty per cent of the cases showed a small secondary rise in temperature while still receiving the drug.

Two patients who ultimately recovered and did not have bacteriæmia showed no apparent response to sulfapyridine, running a typical course of lobar pneumonia. One case ended by crisis on the tenth day and the other by lysis on the eleventh day. In both leucocytosis and rusty sputum containing many viable pneumococci persisted up to the termination of the illness. These cases are of particular interest in that they may represent examples of infection due to "sulfapyridine-fast" strains of pneumococci, the existence of which has been noted by MacLean, Rogers and Fleming,¹¹ and also by MacLeod and Daddi.¹²

The pulse rate and respiratory rate dropped coincidentally with the temperature, but in a few cases the pulse remained elevated at 100 to 110 for 24 to 48 hours after the temperature had reached normal. Cyanosis cleared promptly as the clinical condition improved, and except for the uncomfortable side-effects from sulfapyridine subjective improvement coincided with the drop in temperature.

In only one case was hyperleucocytosis observed, the remainder showing a gradual return to normal with clinical improvement. In the two cases of drug fever which occurred the leucocyte count was normal.

Resolution appeared to progress at the normal rate following the crisis, with the exception of several cases in which treatment was commenced on the first day and in which complete consolidation had not developed. In these resolution was observed to be more rapid than is usually seen following serum or spontaneous recovery.

TOXIC EFFECTS

Nausea and vomiting were the most common toxic manifestations. Eighty-five per cent of the patients complained of varying degrees of nausea, anorexia and abdominal discomfort. About half this number actually vomited. In no case was vomiting severe enough to necessitate cessation of treatment. In an effort to minimize these symptoms the drug was administered as a powdered suspension in milk, but probably the most effective treatment was found to be completely stopping all fluids by mouth,

except those required in giving the drug, for 12 to 24 hours and the intravenous administration of 5 per cent glucose-saline. Troublesome hic-cough occurred in three cases.

Methæmoglobin was found to be present in 3 out of 85 cases in which spectroscopic examinations were done, and in only one patient, who had received the drug for six days and had a blood level of 16.1 mg. of free sulfapyridine, was the amount present enough to necessitate discontinuing treatment. No cases of sulph-hæmoglobinæmia were encountered. One patient developed a toxic erythematous rash after prolonged administration with a high blood level. Fever attributable to the drug occurred in two, both having received well over the average dose. Granulopenia developed in one case after a total dosage of 54 g., but after a stormy convalescence this patient recovered, following repeated transfusions and intramuscular injections of pentnucleotides and liver extract. Acute hæmolytic anæmia was not observed in this series but 4 cases developed non-hæmolytic anæmia with a drop of more than one million in the red cell count. Exfoliative dermatitis, toxic hepatitis and peripheral neuritis did not occur as complications of treatment in any of this series.

A number of authors^{4, 5, 8, 13, 14} have reported renal manifestations arising during the course of sulfapyridine therapy, of which hæmaturia, gross or microscopic in character, associated with the finding of crystals of sulfapyridine in the urine, is the most common. One such case occurred in this series, which promptly cleared on discontinuing the drug. Two additional cases, however, developed renal manifestations of a more serious nature during the period in which they were receiving the drug. These cases presented a picture somewhat similar to that described by Southworth and Cooke.¹⁴ Both patients, except for a trace of albumin, had normal urine on admission. The first signs of renal damage appeared after a total dose of 30 and 33 g. respectively, and in each case the drug was stopped immediately hæmaturia was noted. The chief manifestations were gross hæmaturia with heavy albuminuria, oliguria, bilateral pain simulating renal colic, œdema, urea retention, and, in one case, hypertension. One patient died after three weeks from a large pulmonary abscess, but still with marked hæmaturia, œdema and urea retention. An autopsy showed a severe diffuse nephritis. No calculi were found.

The other patient at the time of her discharge, sixteen weeks after the onset of her disease, still showed hæmaturia, low, fixed specific gravity and slight urea retention. Although the relationship between the nephritis and sulfapyridine in these cases cannot be definitely established, the possibility that permanent renal damage may result from sulfapyridine demands further investigation.

SUMMARY AND CONCLUSIONS

1. The results obtained in the treatment of 105 consecutive cases of pneumococcal pneumonia with sulfapyridine are reported.

2. The mortality rate for the entire series was 9.5 per cent. Type III pneumonia accounted for more than half the deaths, the mortality rate for this type being 23 per cent.

3. The best results were obtained in cases falling into the lower-age groups, in non-bacteriæmic cases and in those treated early in the disease.

4. The dose employed, the response to treatment, and the toxic manifestations resulting from sulfapyridine are discussed.

5. Severe toxic effects may result from sulfapyridine, particularly after prolonged and heavy doses, although their incidence is low.

Our thanks are due to Messrs. Poulenc Frères of Canada Ltd., for large supplies of daganan in the treatment of these cases.

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THE EFFECTS OF TEA DRINKING

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IT is of some importance to know exactly what physical effects are produced by a drink so widely used as is tea. Patients are quite frequently warned against taking it, but it is doubtful if the prohibition is always justified. There certainly is little enough about it in the medical literature.

The following investigation was undertaken to find out just what effects tea does produce in the average human being. We had in mind only the drinking of tea as it is ordinarily done in Canada. Excessive consumption of strong tea was not considered. Nor have we tried to establish any special claims for the value of tea.

THE CHEMISTRY OF TEA

Much, but not everything, is known about the chemical composition of tea.¹ Its two chief constituents are caffeine and tannin. In addition to these there are minute quantities of minerals and of volatile oils which have been identified but their action not fully determined. It may be said at once, to dispose of them, that they are only present in very small quantities;

amongst them are valerianic acid, phenol, pyridin, and certain nitrogenous aromatic substances. They play an important part in the fragrance of a cup of tea, but their physical effects in tea drinking are negligible.

Caffeine is a familiar alkaloid, with well defined powers of stimulation and diuresis. The amount of caffeine in an ordinary six-ounce cup of tea, infused for five minutes, is about one grain, compared with about two and a half grains in the same volume of coffee. A longer brewing does not increase the amount in a cup of tea to any great extent, since caffeine is very soluble, and three-quarters of the amount in the tea leaves is dissolved out in the first three minutes. Hence it is that the addition of fresh hot water to tea which has already been infused is a less stimulating brew.

Tannin is also a familiar substance, with the well recognized property of being able to coagulate proteins and gelatine, to form insoluble tannates. This, of course, is the basis for its astringent action physiologically. Tea tannin, however, presents great variation both in its

chemical nature and in the quantities in which it is present in different brands of tea. The tannins of tea are much less astringent than the tannic acid of the pharmacopœia.

The quantity of tannin in an ordinary cup of black tea is about two grains, often less. A five-minute brewing only extracts about one-third of the tannin; a longer brew of course increases the amount, but only moderately.

Efforts have been made to establish some relation between the quality of different teas and their content of tannin and caffeine.² But the variations in the proportions of these substances are too wide to permit of such a conclusion. Tannin, for example, is a most important factor in the colour, pungency, and "briskness" of tea. Some teas, however, contain much less tannin than others, but have qualities such as aroma and fragrance which still keep them in the class of good tea. The caffeine content varies less than does the tannin. The following analyses chosen at random from a large group of teas will illustrate the point.³

Various brands	Caffeine Percentage	Tannin Percentage
Cheap India tea	2.81	14.76
Cheap India tea	4.91	16.61
Higher price India tea ..	3.48	14.81
Cheap Ceylon	2.34	12.00
High price Ceylon	3.65	12.24

Chemical analysis, therefore, cannot be depended on as a guide to the quality of a tea. The tea taster still is the supreme arbiter, and his judgment is practically infallible. A group of tea tasters will give independent classifications of brands of teas which will be almost identical. Apart from individual preferences, the price of a tea is a fairly reliable index of its quality, the lower priced being much more likely to produce unpleasant physiological effects.

METHOD OF INVESTIGATION

The investigation was carried out on a group of ten young healthy adults, five of each sex. It lasted for a little more than a month, and in that time the effects of the following substances were observed: (a) tea; (b) coffee; (c) caffeine; (d) tannin. In addition to the clinical effects of these substances experiments were carried out on their influence on peptic activity *in vitro*, to measure which Metts tubes were used.

The tests were carried out in the day. Patients arrived at 8.30 a.m., after an ordinary

breakfast, exclusive of tea or coffee. They voided and the specimens were discarded, after which they lay down. Half an hour later the fluid to be tested was given, each individual receiving three eight-ounce cups, with intervals of 45 minutes between each cup. Throughout the morning a nurse observed and noted the objective and subjective symptoms—blood pressure, temperature, pulse, respirations and any special signs or symptoms.

At noon the patients were allowed up, and ate a regular lunch of meat, vegetables and a dessert, but no fluids were taken. One cigarette was allowed after meals, but no more.

At 1.30 p.m. they again lay down and resumed the morning routine of half an hour's rest, followed by the three cups of testing fluid at 45-minute intervals. They went home at 4.30, and were allowed anything they wished for their evening meal, together with reasonable activities, but no heavy smoking or drinking was permitted.

Throughout the day at the hospital the urine was measured, from 8.30 a.m. to 4.30 p.m. The intake also was recorded. The blood pressure, temperature, pulse and respirations were taken three times a day, at 9, 12, and 4, and were charted. Reading, writing, knitting, and talking were allowed throughout the day, but no other activities.

METHOD OF PREPARING THE TEA

Two forms of tea were used; (a) a good average Canadian brand; and (b) a cheaper brand. These were put up in bags each holding enough to make ten cups of tea, the amount of tea to each cup being 30 grains. The bags were placed in large ten-cup teapots, which were filled with boiling water and allowed to brew for five or ten minutes, as the experiment required.

The cups held just 8 ounces each. When milk was used, one ounce was added to seven ounces of tea. The amount of sugar used was one dram to a cup. The amount of lemon, when used, was one dram.

Coffee was made by percolation, using one tablespoonful (15 grains) to each cup. It was allowed to percolate for seven minutes. A good well known brand was used.

CLINICAL EFFECTS

Cups of cold and hot water, respectively, had no effects on the pulse, temperature, blood pressure and urinary output.

Good tea, clear, 5-minute brew, produced pleasurable effects in all the patients; a few perspired slightly, but there was no change in any of the objective findings. Four were given the tea cooled, with no different effects. With milk and sugar added, the same pleasurable effects were noted, and no changes otherwise. With lemon juice added, there were, similarly, no particular effects.

A *10-minute brew* of the same brand of tea, clear, produced definite symptoms of distaste, with slight nausea and some abdominal discomfort in three cases. With milk and sugar added, these unpleasant effects were replaced by the pleasurable stimulation of the weaker brew.

Cheap tea, clear.—With the 5-minute brew some patients thought the taste was even better than the good brand, whilst others thought it bitter and less palatable. Four complained of some abdominal discomfort, and one was slightly nauseated with the last cup. With milk and sugar added, the bitterness was removed, and all found it pleasant enough, with no other effects.

The *10-minute brew* of this brand, clear, was definitely too strong and bitter. Nearly all of the patients were nauseated, and many complained of abdominal discomfort. When milk and sugar were added, this strength was found to be more palatable, but it still produced some abdominal discomfort.

Coffee.—Here the results were roughly similar, in that a 7-minute brew (the ordinary length of percolation) gave pleasurable effects, and the stronger, 10-minute brew was found to be more bitter, although producing no special symptoms.

EFFECTS OF CAFFEINE AND TANNIN

Caffeine.—This was given in $2\frac{1}{2}$ grain doses in a cup of hot water six times in the day, a total of 15 grains. In each instance there was marked general disturbance. Some patients were stimulated with the first dose, but after that they all became nauseated and depressed, and two vomited. They perspired freely. Some had abdominal pain, and the extremities were cold and clammy. These effects lasted well into the evening, and most of the patients did not sleep, and even felt the effects the next morning. In each case there was a rise in the pulse rate and blood pressure, 10 to 30 points, and marked diuresis.

Tannin.—This was given in the same way, using B.P. tannic acid, in 5-grain doses. All the patients were nauseated after the second dose, and five vomited with the third. Several developed headache and abdominal discomfort, with perspiration and clamminess of the extremities (in two cases). All showed constipation. The pulse was slowed markedly, and the blood pressure was lowered, but not constantly.

Caffeine and tannin in combination.—These were given in hot water, $2\frac{1}{2}$ and 5 grains, respectively. This combination produced less discomfort, but all complained of the taste, and some were nauseated. The pulse was slowed in some cases, but there was no constant change in blood pressure or output.

GASTRIC ANALYSES

Four analyses were carried out on each patient. These were done at the first of each week, the patients reporting without breakfast. A No. 14 French Levine tube was passed, and after the fasting contents were aspirated and the testing fluid given, samples were taken at 15-minute intervals for 75 minutes—six specimens in all.

The following test solutions were used: (a) a 5 per cent solution of alcohol and water, 8 c.c. of alcohol and 142 c.c. of water; (b) clear tea, 5-minute brew, with alcohol, in the same 5 per cent proportion, 150 c.c.; (c) clear tea, 5-minute brew, 240 c.c.; (d) plain hot water, 240 c.c.

The samples were measured and the colour noted, and filtered through a No. 42 Whatman filter paper. The filtrate was titrated within a few hours and its free HCl and total acidity measured by N/10 NaOH. The indicators were phenolphthalein and methyl orange.

Peptic activity was measured on the following day (the filtrate was kept on ice) using one c.c. of gastric juice, plus 15 c.c. of N/20 HCl and two Metts tubes, about one cm. in length. These were incubated at 38° C. for 24 hours, and then digestion was measured, using a micrometer scale with a microscope.

The object of these numerous analyses was to find out what effect tea had on the stomach juices. Alcohol, of course, is used commonly in test meals for its stimulant effect, and it was thought that it would serve as a useful basis of comparison.

The results are shown in the Table below. This gives the average figure for the 15-minute

samples taken throughout the 75-minute periods, showing the resultant free HCl and peptic activity. As the total acidity followed the free HCl very closely it is not shown in the Table.

ends of the Metts tube and taking an average.

Tea.—Five c.c. of tea, clear, 5-minute brew, in the flasks, caused only slight depression of activity, but 10, 20, and 30 c.c. showed a definite

EFFECTS OF TEST SOLUTIONS ON ACIDITY AND PEPTIC ACTIVITY

	Hydrochloric acid				Peptic activity			
	Alcohol and water	Alcohol and tea	Water	Tea	Alcohol and water	Alcohol and tea	Water	Tea
Brown.....	32.3	21.1	8.3	0	289	182	397	9
Borsman....	0	28.5	25.1	19.5	75	297	240	176
Burkitt.....	18.8	16.8	17.0	8.5	212	265	204	104
Hargadon...	22.0	17.8	15.3	11.8	294	214	266	306
Storey.....	10.6	13.1	1.1	10.1	118	89	78	59
Bush.....	8.5	16.5	8.0	14.0	97	127	180	130
Drury.....	19.6	10.3	5.8	12.8	210	126	117	163
Herman.....	18.1	32.8	11.0	12.5	281	298	154	186
Pangborn...	23.0	10.6	6.8	14.6	250	227	141	204
Robinson...	0	4.1	0	0	0	45	5	1

The free HCl in five cases was high with alcohol and water, and in the other five was high with alcohol and tea. The stimulation with alcohol was always greater than with water or tea alone. Thus it may be said that tea does not stimulate acidity any more than does hot water. This is very much the same conclusion as was reached by Gantt⁴ in experimental work. He found that the chemical action of a mixture of tea and bread on the stomach secretions was practically the same as that of bread and water. The increase in juice was very little. The effects seem to depend almost entirely on the individual, there being no chemical influence due to the tea itself.

It is much more difficult to interpret the effects on the peptic activity. This follows no set rule, and is so easily affected by various elements, such as emotion and other psychic factors that it is not possible to establish an average or "normal" level. It is quite evident, however, that tea *does not stimulate* peptic activity, nor, on the other hand, does it depress it appreciably. The highest point to which activity rose, and this in two cases alone, was only slightly above that produced by alcohol.

EFFECTS ON PEPTIC ACTIVITY IN VITRO

The next step was the testing of the effects on peptic activity *in vitro*. This was done by incubating one c.c. of the gastric juice and 15 c.c. of N/20 HCl in a 50 c.c. Erlenmeyer flask, which served as a control. To this the various fluids were added. Peptic activity was estimated by measuring the digestion at both

decrease of activity. There was a similar depression with the addition of milk, and also with lemon.

Water and milk.—Water in large amounts (30 c.c.) produced a slight decrease in activity, whilst milk gave a marked depression, no digestion at all being found in some of the tubes. Water with a small amount of milk acted in the same way as plain water.

Caffeine.—This showed no effect on peptic activity, in amounts up to two grains.

Tannin.—This, in 10 and 30 c.c. of water, alone or with milk, caused a definite depression of activity. One-quarter of a grain produced no effect, but $\frac{1}{2}$ and 1 grain in 10 and 30 c.c. of water had a definitely depressing effect.

Coffee.—This showed a depressant effect on the activity, similar to that of tea.

Caffeine and tannin in combination.—Small amounts of caffeine, $\frac{1}{6}$ to $\frac{1}{4}$ of a grain, mixed with 1 grain of tannin in 10 c.c. of water, depressed the peptic activity more than $\frac{1}{2}$ and 1 grain of caffeine with the same amount of tannin. The addition of milk produced no change in these results.

THE EFFECT ON THE BASAL METABOLIC RATE

So far as we can ascertain the effect of tea on the basal metabolic rate has not been estimated, and it was considered worth while to investigate this point. The fluids tested were: (1) clear tea, 5-minute brew; (2) the same tea with milk; (3) clear tea, 10-minute brew; (4) 10-minute brew with milk; (5) 10-minute brew with milk and sugar. Sixteen tests were carried out.

Fasting metabolic rates were first done on each patient. Then, 8 patients were given clear tea, 5-minute brew, and 6 were given tea and milk, brewed 5 and 10 minutes. The basal metabolic rate was taken half an hour, one and a half hours, and two and a half hours afterwards. Two were given tea with milk and sugar.

In brief, the results were that 9 patients showed a slight increase, averaging +3.5, and 5 showed a similarly slight decrease. In the opinion of Dr. I. M. Rabinowitch, by whose Department of Metabolism at the Montreal General Hospital the tests were carried out, the changes were negligible, even the addition of milk having no effect on the basal metabolic rate.

In detail the results were as follows.

	No. of patients	Results
Clear tea, 5-minute brew	Four—2 male 2 female	Three showed a rise: +2, +3, +5. One showed a decrease: -4
Tea and milk, 5-minute brew	Two—female	One, no change. One, an increase of +2
Clear tea, 10-minute brew	Four—2 male 2 female	Three had a rise: +4, +3, +7. One had a decrease: -3
Tea and milk, 10-minute brew	Four—2 male 2 female	Two had a rise: +2, +4. Two had a slight decrease.
Tea, milk and sugar, 10-minute brew	Two—1 male 1 female	One had a rise of +7. One a decrease of -2

GASTROSCOPIC EXAMINATION

Three patients were examined with the gastroscope immediately after completion of the experiments. All showed a mild superficial gastritis, non-symptomatic, which consisted of slight reddening of the gastric mucosa, with occasional adherent patches of mucus. One of the examinations was repeated two weeks later, when no trace of gastritis could be found. It was probably due to the doses of tannin and caffeine which had been given, and the four

gastric analyses done on each patient should also be taken into account.

BARIUM MEAL EXAMINATION

One patient was examined by x-rays with a barium meal. A preliminary series was taken with the ordinary barium sulphate meal, plates being taken immediately, and at 1, 2, and 6 hours. The barium meal was then repeated, mixing in 150 c.c. of tea, 5-minute brew, instead of water, and the same series of plates was taken. Comparison of the two series showed that the barium meal with the tea produced some slowing of advance from the stomach, but one case is not enough to warrant any definite conclusion as to the effect of the tea in the retardation.

CONCLUSIONS

Good tea, brewed for five minutes, produces mild and pleasant stimulation, in no sense corresponding with the violent, unpleasant action of its main components, caffeine and tannin, when these are given separately or in combination.

Strong tea, brewed 10 minutes, may produce some mild discomfort, but the addition of milk nullifies this.

Cheap tea, weak, may suit some palates, and has no objective effects, but in strong infusion is apt to be unpleasant.

The effects of tea on gastric acidity and peptic activity are slight and variable. Tea does not increase acidity.

Tea does not seem to alter the basal metabolic rate.

Our thanks are due to the Sun Life Assurance Company, whose kindness in allowing us to use their excellent hospital quarters was of the greatest help; also to Professor B. P. Babkin and Dr. I. M. Rabinowitch, of McGill University, for suggestions.

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Words can but little stay the tides that surge
When friend from friend must sever;
To meet, it may be never. . . .
What glad release from care and crowded street,
At last to close thy door and go away
Among the hills! . . .
—Leon J. Richardson in "Cronies".

Fear no more the heat o' the sun,
Nor the furious winter's rages;
Thus thy worldly task hast done,
Home art gone and ta'en thy wages;
Golden lads and girls all must,
As chimney-sweepers, come to dust.
—*Cymbeline*, Act IV, Scene 2.

THE MEDICAL SERVICE AND MECHANIZED FORMATIONS

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THE functions of the Medical Services in war include the maintenance of a high standard of health among the troops engaged and the collection and evacuation of casualties from the immediate scene of action, their treatment and subsequent disposal.

It seems probable that in future wars armies will be smaller in the initial stages, more efficient, and include a percentage of armoured formations possessing a high degree of mobility. The use of armoured fighting vehicles (A.F.Vs.), such as tanks and armoured cars, presents new problems, particularly in the collection and evacuation of casualties. There is little to be learned from the experiences of the last war. It is instructive, however, to speculate on the problem and review our present ideas, but in order to do so intelligently it is necessary to state the present organization.

It may be assumed that an army corps will consist of at least two divisions and accompanying corps troops, in numbers approximately 40,000. The various units all have mechanized first line transport and troop-carrying mechanical transport units, thus permitting far greater mobility than that obtained in any past war. Also there may be attached to the army corps an armoured division (10,000) consisting of two mechanized cavalry brigades, a tank brigade, and the necessary auxilliary troops, such as engineers, army service corps, ordnance corps, and medical units.

At present the method of employment of an armoured division or one of its brigades can only be tentative, and the correct method must be left to experience, but some possible rôles are: reconnaissance, raids, offensive action in direct or indirect cooperation with a main attack, guarding a flank, or covering a withdrawal or advance. Distances of from 50 to 100 miles or more may have to be covered, often in enemy infested or unfriendly territory.

The units comprising the armoured division vary in strength up to 600 and are divided into "A" Echelon consisting mostly of A.F.Vs. and "B" Echelon consisting of the unarmoured supply and maintenance vehicles.

The medical organization to serve the above units is as follows. Each unit has a Regimental Medical Officer (R.M.O.) with the necessary technical equipment. There is also the usual detail of men trained in sanitary and water duties. Each A.F.V. has one man trained in first aid and carrying a small first aid outfit. The R.M.O. is provided with an unarmoured, 15 cwt. 4-wheeler, a truck to carry himself and equipment. It is to be noted that there are no special vehicles with a tank battalion or armoured car unit with which to collect wounded.

The mechanized cavalry field ambulance is by virtue of its organization and mobility theoretically suitable for employment with highly mobile formations such as mechanized brigades, and its use in that capacity is provided for. It would seem that at least two such units will be required for an armoured division, which as we have seen consists of two mechanized cavalry brigades and other attached details.

A mechanized cavalry field ambulance has the following personnel: Medical Officers 7; Quartermaster 1; R.C.A.S.C. officer 1; Dental Officer 1; other ranks 167. It is divided into a headquarters and four sections, each section having 1 Medical Officer and 7 other ranks. The following motor vehicles are provided to enable the unit to carry out its duties: 8 motor cars; 9 motorcycles; 13 light lorries, six-wheeled; 1 travelling kitchen; 1 water tank trailer and 12 six-wheeled ambulance cars, each equipped to carry four stretcher cases.

The unit is so organized that the headquarters can establish a main dressing station (M.D.S.) and each of the four sections, an advanced dressing station (A.D.S.). The dressing stations can be opened and closed very rapidly, and may need to move several times during a day, particularly the A.D.S. The sections are very mobile and self-contained and would be less elaborate than such posts established by a field ambulance with an infantry division.

During quiescent periods the collection, evacuation and care of sick and injured, require no special arrangements. The same method as employed in an ordinary infantry unit will suffice.

Neither will "B" Echelon (the non-fighting vehicles) require any departure from the usual procedure. There will however need to be more men trained in first-aid, since at least one is required for every A.F.V. and the others should have a knowledge of how to use the first-aid outfit.

If a unit is on the move casualties will have to be carried along, until arrangements can be made to evacuate. Every opportunity should be taken to shed casualties. Long distances may have to be covered in clearing cases, and ambulances would often have to go in escorted convoy with supply lorries. Owing to danger from enemy air-action medical personnel will be required in bus columns, and could be accommodated in motor ambulance cars. The casualties could be attended to and carried forward with the column.

It will be necessary to take it for granted that you are familiar with the methods of handling casualties from units not highly mobile, i.e., the system from regimental aid-post (R.A.P.) to casualty clearing station (C.C.S.). The collection and evacuation of casualties from mechanized units when actively operating are as yet purely theoretical. The main point is how to get the injured man back in the quickest possible time to a place where he can be given adequate hospital treatment. This may mean a distance of 100 miles.

ESTIMATION OF CASUALTIES

The number of casualties expected in A.F.Vs. should not be as numerous as in infantry units. Approximately 5 per cent (apart from dead) would be a reasonable figure in an average engagement (20 per cent in infantry). Nor would the number of wounded requiring lying-down accommodation be expected to be as numerous in proportion. If a tank or armoured car is penetrated or blown up by an exploding shell the crew would probably all be killed. The bulk of the wounds will therefore be from small splinters of bullet casings or scalings from the inner side of the armour. These cases would nearly all be classed as "sitting or walking". A fair proportion of stretcher cases would be 10 per cent of the total casualties.

The above sitting cases could be carried along in the A.F.Vs. until the rendezvous is reached or an opportunity occurs to shed them to a medical unit. This journey would be exceed-

ingly unpleasant owing to roughness of ground, cramped space in vehicles, etc.

Let us imagine a mechanized cavalry brigade making an attack of the "tip and run" nature on an enemy convoy proceeding along a road some fifty miles away. The method of attack would probably be to proceed to a point from which the attack could be made from cover, destroy the convoy as much as possible, and return to a definite assembly point. Such a mechanized cavalry brigade might consist of: Hqtrs. Cav. Bde. (mech.); 3 Cav. Light Tank Regts.; R.C.A.S.C. Coy. (mech.); Signal Sqdn. Total approximate strength 2,000. The normal medical establishment would be 15 cwt. trucks for 3 R.M.Os. and equipment. In addition a mechanized cavalry field ambulance would be attached to the raiding force. You will recall this unit is so arranged that it can form one M.D.S. and four small A.D.Ss. All its vehicles are capable of cross-country movement.

All the medical details would be at the point of rendezvous some distance in rear of the A.F.Vs. prepared to function immediately. If the action were successful there would be no difficulty in ambulance cars and R.M.Os. vans going forward and collecting all casualties from the derelict vehicles. Vehicles returning to the rendezvous would bring back their own casualties, to be handed over to the dressing station established by the field ambulance. In the case of an unsuccessful action there would be no possibility of recovering wounded from derelict A.F.Vs.

TREATMENT IN THE A.F.Vs. AND BY R.M.O.

The only treatment the wounded in A.F.Vs. could reasonably hope to receive during an action and for a short time afterward would have to be given by their comrades. Hence every man of the crew should be trained in the use of the first aid kit. The R.M.O. is not accommodated in an armoured vehicle, hence cannot in some cases be further forward than a re-filling rendezvous, unless it is possible to push forward the medical van and an ambulance under escort, and establish an R.A.P. It is very doubtful if casualties can be removed from A.F.Vs. while the vehicles are in the area of active operations.

A solution to the problem might be found in a lightly armoured six-wheeled lorry, fitted up as a mobile R.A.P. to carry two stretcher cases, the R.M.O., his orderly, and equipment. The lorry to be provided with a foldup "lean to" for each side, capable of being pulled out from

the side or of quick attachment to the side, similar to the lean-to of a modern motor car-house trailer. This would enable the R.M.O. to go forward and establish a two room R.A.P., which can be opened and closed very quickly. The R.M.O. could render assistance to wounded, then leave them in a suitable sheltered place, to be later collected by the ambulance cars of the mechanized cavalry field ambulance. Such a vehicle would permit the R.M.O. to keep closer touch with the A.F.Vs. and prevent him from being a considerable distance back, where ample medical aid will always be available from the field ambulance. Such an experimental lorry has already been tried out on army manoeuvres (1936). The tank R.A.P. has been tried but has not been satisfactory. Ambulance cars would need to be detailed to enable the R.M.O. to collect casualties from a distance, or perhaps a light motor ambulance (2 patient) or two, motorcycle, side-car stretchers. These latter have proved satisfactory in actual warfare.

THE COLLECTION AND EVACUATION FROM R.A.Ps. AND A.D.S.

The next step is the evacuation of the casualty from the R.A.P. or nests of wounded, which have been established by the R.M.O. near the fighting area. These posts may be widely scattered and very difficult to locate. The onus of evacuation falls on the field ambulance, the headquarters of which would have opened its M.D.S. at the rendezvous or refilling point some distance in rear of the actual fighting area. The sections of the field ambulance (4 in number), each self-contained, consisting of one M.O. and 7 other ranks, and having 1 motor car, 2 seater, 1 lorry and 1 motorcycle (for intercommunication) would establish small mobile A.D.Ss. as far forward as possible. All sections would not be operating at one time, for at least one should be held in reserve for emergencies. Sufficient ambulance cars would be allotted from the unit headquarters to serve each A.D.S. There are 12 ambulance cars, 6-wheeled, each carrying 4 stretcher cases available for the entire field ambulance, which number does not appear to be sufficient. Additional ambulance cars, some of which could be a light 2 stretcher type, would seem to be indicated.

With regard to the A.D.S. established by the section of a field ambulance it is suggested that the section lorry could be fitted in the same manner as the R.M.Os. lorry described above,

and thus be quite suitable for A.D.Ss., bearing in mind that the casualties must be got rid of quickly; hence large accommodation is not required. The idea could be further elaborated and provide a trailer to the lorry and expand into a more elaborate mobile dressing station.

The main requirements of the A.D.S. are that it could be rapidly transferred from place to place, open and close quickly (10 min.), carry out minor emergency surgical work, carry all equipment and personnel required, and be as small a unit as possible.

One of the biggest worries would be keeping in touch between M.D.S., A.D.Ss., and R.A.Ps. For this purpose 9 motorcycles are provided which would very likely need to be considerably increased. Of course returning ambulance cars could also be utilized to keep contact.

EVACUATION FROM M.D.S.

The evacuation from the M.D.S. should not prove difficult. This is carried out by the Motor Ambulance Convoy (M.A.C.), an entirely separate unit of 75 cars. The main difficulty would be of course the length of the run for the cars (50 miles) which might be over dangerous roads. If the roads were free of enemy raids the distance would not matter so much, for the cars could proceed at their own speed. If however it was necessary to proceed in a protected convoy with supply lorries the speed would be very much reduced. Hence many more cars would be needed. The suggestion to have ambulance cars armoured against even rifle bullets is not very satisfactory, since to render a car reasonably safe also makes it very heavy, slows it up, and cuts down the carrying capacity. It would appear that an unarmoured ambulance car will have to be used and the risk taken. A limited number of serious cases requiring rapid evacuation might be taken care of by aeroplane ambulance.

In a situation as outlined above it is very doubtful if it would be necessary to establish an M.D.S. as is usually understood. The main object in evacuating casualties is to get them to a C.C.S. as soon as possible and without unnecessary transfers at various dressing stations. The M.D.S. might easily be conceived of as a place for keeping records, and from which to supply and administer the unit, and not as a dressing station to overhaul dressings already satisfactorily put on. It is remarkable what a small

percentage of wounds require re-dressing after they have passed through the R.A.P. and A.D.S.

THE MAINTENANCE OF HEALTH

Regarding the maintenance of the health of the troops the same general principles apply in mechanized warfare as formerly. There are however some factors peculiar to mechanized units which may well be brought to the attention of medical officers.

The principal injuries peculiar to tanks and other A.F.Vs. are dermatitis from petrol burns, eye injuries from steel splinters, concussion due to explosions near tanks, burns, carbon monoxide poisoning, and bruising and fatigue due to being thrown against the interior of the turret or tank wall. There is also a type of tank sickness of which the symptoms are headache, faintness, giddiness, vomiting, mental confusion, irritability, rise in temperature and pulse, flushed face, sometimes convulsions, collapse, and unconsciousness. These symptoms may oc-

cur after 3 hours in a tank, and are thought to be due to the cumulative action of carbon monoxide from petrol fumes, back-firing of guns, bad ventilation, humidity, muscular activity, anxiety and mental worry. The symptoms soon pass off, but the crews are exhausted and not fit for duty for from 2 to 7 days.

The following preventive measures might help, improved ventilation fans, to remove fumes and prevent overheating, maintaining a distance of 25 yards between tanks, drivers to work in relays, the regular examination of crews.

In long drives with a big column of motor vehicles in close formation the inhaling of dust and fumes from exhaust pipes causes respiratory disorders. The drivers complain of abnormal drowsiness and eye irritation. Some type of mask such as used in sand-blasting might be of help. Greater spacing between vehicles would help, but this would render the column dangerously long. Leading exhaust pipes along the top of vehicles might be tried.

DEATHS AMONG WAR PENSIONERS*

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IN considering medical statistics for those pensioned for injury or disease due to war service it was known that approximately 16,000 such pensioners had died, and before undertaking any extensive investigation on the larger group, the living pensioners, it was deemed advisable to make a complete study of those who had died, because for this group the books have been closed and the end-results are known. Further, their numbers were great enough for the striking of satisfactory death rates.

We have no records for the large body of returned men who have not been awarded pension. It must be borne in mind that the advantages enjoyed by the pensioner respecting treatment, hospitalization, and financial security, which have undoubtedly been a factor in causing his bettered expectancy of life, do not apply to the non-pensioner, or, for that matter, to the bulk of the civilian population. We have endeavoured

to find whether or not pensioners are dying of the same causes as the male population of Canada, and at what rate, and we have tried to measure the effect of war service on the death rate and to determine what diseases are most influenced by war service.

At the beginning of the work we were under the impression that we would find certain phases marked out by well-defined points of time. We had precedent for this, because certain things happened in certain calendar years; for example, the war began in 1914, ended in 1918, general demobilization in 1919, etc., but we were gradually forced to a different conception because we found that the age of the veteran was the principal guiding factor. The man's age dominates all other considerations.

We coded diseases, war disabilities, and deaths by means of the Standard Morbidity Code based on the same classification as the International list of Causes of Death. This made it possible to compare our rates with those of the Dominion Bureau of Statistics. The information for the

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study was collected from the Master Pension Card, the Treatment Card, the Death Card, and, when necessary, from the military files and original military documents. We endeavoured to record the causes of death, both primary and secondary, pensioned conditions up to three in number, year of pension award, year of major pension award, amount of pension on award and at death. We paid some attention to the latter point because it was known that the Pension Commission was concerned with the steady rise in the per cent of pension awarded for chronic disease, and it is in the mind of the Commission that there should be some point of time at which a halt in this increase could honourably be called. We now know that any halt in increase should be governed by the age of the pensioner and the condition from which he suffers rather than by a calendar year.

We first took the number of pensioners and total deaths among them by calendar years, and had a table prepared by an actuary, in order to find the trend in deaths of pensioners as against the Canadian male population of similar age-structure. Owing to a large movement in and out of the pension group between the years 1920 and 1932 the first table was prepared by using certain "smoothing" procedures. Upon closer study and upon the advice of the Dominion Bureau of Statistics a second table was prepared by them, using only the exact figures for the number of pensioners and deaths by calendar years, and, from the latter the various rates were struck. The general trend in both tables is approximately the same.

There has been much conjecture concerning the pre-aging of war veterans, and rough estimates ranging from five to ten years of lessened expectancy of life have been made. The impression is abroad that the pensioners, and probably all veterans, are now approaching a period in which their death rate will be excessive as compared with the Canadian males. This study proves the reverse to be true, so far as the pensioners are concerned. The highest death rate was suffered just at the end of the war and among the younger age groups, but from 1921 to the present there has been a steady decline in the pensioners' death rate until today it is comparable with the rate for Canadian males, as seen in Table I.

From the summary below it will be seen that while non-fatal wounds and gassing account for 138,153 casualties, the total living pensioned for

TABLE I.

Year	Pensioner population exposed	Actual deaths among pensioners	Expected deaths on basis of Canadian Life Table 1930-32	Ratio of actual to expected deaths
	A	B	C	D
1918	15,335	....	...	....
1919	42,932	1,796	577	3.28
1920	69,203	....	...	....
1921	51,452	530	246	2.16
1922	45,133	729	225	3.24
1923	43,263	536	225	2.38
1924	43,300	537	236	2.28
1925	44,598	505	255	1.98
1926	46,385	590	278	2.12
1927	48,027	605	305	1.99
1928	50,635	671	339	1.98
1929	54,620	637	388	1.64
1930	56,996	723	430	1.68
1931	66,669	719	532	1.35
1932	75,878	845	645	1.31
1933	77,967	874	704	1.24
1934	77,855	927	749	1.24
1935	78,404	990	806	1.23
1936	79,124	1,040	869	1.20

Column "D" shows the steady decline in the ratio of actual to expected deaths among pensioners—1.20 approximating normal.

SUMMARY WOUNDS AND DISEASE

Non-fatal wounds.....	126,512	138,153
" gassing.....	11,641	
" accidents.....	34,352	

Total non-fatal casualties other than disease..... 172,505

Total pensioned for wounds.....	45,478
*Major pension disability wounds.....	29,769
" " " amputations.....	2,596
	32,365

DEATHS FROM DISEASE DURING WAR

Deaths due to influenza and pneumonia.....	3,510
Deaths from all other diseases.....	3,256
Total deaths due to disease during the war.....	6,767
Major pension disability wounds.....	32,365
" " " disease.....	47,424
Total pensioners (March, 1937).....	79,789

*The term "major pension disability" is used to indicate the chief pensionable condition where more than one exists.

these conditions number 45,478, and of these 32,365 have wounding as the major pension disability. Major pension disabilities from disease number 47,424.

If we now examine the first half of Chart 1 we find a month by month crude death rate from disease for the five consecutive years between mobilization and final demobilization superimposed upon the normal death rate for Canadian males of similar age for the registration area of Canada for the year 1921. It will be seen that for the first four years of the war

the military death rate is slightly lower than that for Canadian males. The sharp rise in October, 1918, due to the influenza epidemic, is comparable in time and height with the civilian deaths, as recorded for Ontario during the same period. The rise in 1919 represents the second influenza outbreak, but as the number of men not yet demobilized was small this rise may be out of proportion and unreliable.

If we consider that for the duration the enlisted men suffered a death rate from disease which was a little lower than that for civilian males it is rather surprising that the major pensions awarded for diseases incurred on service far outnumber the major pensions awarded for non-fatal wounds. This seems more evident since we now know that the pensioners as a group have had an approximately normal death rate since 1930.

The generosity of the government in awarding pensions for chronic disease is amply borne out by the above findings, which also indicate that adequate medical service, as provided in the army and to the pensioners after the war, is undoubtedly a factor in lowering the expected death rate, and prolonging the expectancy of life.

The complete chart follows the soldiers' death ratio, due to disease, from the beginning of the war until the last surviving pensioners are dead. (Following demobilization, the number who died solely from the after results of enemy action was so small that the disease rate is not influenced by their inclusion).

It is evident that the total number under observation, following demobilization, including those who died during the period, is in the neighbourhood of 100,000 men of adult age, and from the study of this large group suffering from widely diversified ailments emerges certain new information: (1) Impaired men do not tend to become relatively more impaired as a group. (2) With adequate medical care many pensioned conditions eventually prove to be curable or become arrested. (3) With the passage of time there is a persistent and progressive tendency towards the normal average for age.

It might be stated thus: impaired adults, given adequate medical care and a measure of economic security, do not tend to become more impaired as a group, but tend to attain average mortality for their age in approximately ten years.

At the end of March, 1937, living pensioners were distributed by chief causes of disability according to Table II. It also shows the number of pensioners who have minor as well as major disabilities, together with the total disabilities suffered by the 79,789 pensioners.

TABLE II.
DISTRIBUTION OF DISABILITIES BY CHIEF CAUSES

Disease or disability	Number of pensioners where disability is		Total number of disabilities
	"Major"	"Minor"	
Tuberculosis.....	4,460	611	5,071
Tuberculosis other than pulmonary.....	250	281	531
Total tuberculosis..	4,710	892	5,602
Cancer—Tumours.....	113	100	213
Rheumatism—Nutrition	6,035	3,611	9,646
Blood and blood-forming organs.....	26	40	66
Intoxication—Chronic poisoning.....	4,257	2,965	7,222
Nervous system.....	6,628	4,532	11,160
Circulatory.....	8,242	5,260	13,502
Respiratory.....	3,175	2,655	5,830
Digestive.....	1,766	1,281	3,047
Genito-urinary.....	2,596	2,231	4,827
Amputations.....	6,070	2,524	8,594
G.S.W.'s—Involving joints	23,699	8,358	32,057
G.S.W.'s—All other.....	12,472	10,424	22,896
Other disabilities.....			
Grand total.....	79,789	44,873	124,662

Fifty years ago, 94 per cent of all mortality from disease was due to acute illness (epidemic diseases such as smallpox, typhoid, diphtheria, etc.). Today, 75 per cent of all deaths from disease are due to chronic illness, and the causes fall under a very few heads, the chief of these being tuberculosis, heart disease, respiratory disease, cancer and nervous diseases. If we apply these same few causes to pensioners' deaths, we can account for more than 90 per cent of those dying.

The Great War might be cited as a war in which there was very little serious disease causing death as compared with former wars. (There were, of course, many cases of non-fatal disease and minor ailments). The only epidemic of any consequence was that of influenza, which appeared in 1918. The proof of the above statement is borne out by the fact that deaths from disease for the duration numbered only 6,767, and influenza and pneumonia, acute diseases, accounted for over 50 per cent of these deaths. This leaves about 3,000 deaths from all other disease causes. There were approximately 127,000 non-fatal wounds. Thirty-nine to 40 per cent of those serving in a theatre of war

suffered non-fatal wounds, and 54 per cent suffered both non-fatal and fatal wounds. These figures are introduced to show the discrepancy between the number of pensioners who died of chronic disease related to service and those who subsequently died as a direct result of wounding.

It must be borne in mind that all persons in this study were discharged from the expeditionary force to pension. Therefore, wounded men who eventually died in hospital and who were never struck off strength are not included.

Chart 2 shows the pension disposition of 576 men who served in Canada only and whose deaths were attributable to service. These constitute 50 per cent of the total. (Total deaths in those who served in Canada only 1,145). It is noted that 186 received 100 per cent on award, but at death 312 were receiving 100 per cent.

The high death rate from tuberculosis is probably due to the fact that the disease was discovered soon after enlistment, and the men were weeded out as unfit for service abroad and boarded to pension. This process concentrated the amount of tuberculosis in those who served in Canada only.

CONSIDERATIONS

Future enlistments.—There are certain matters that the Department of National Defence might well consider in connection with any large scale mobilization in the future. First, it is evident that an x-ray record of every chest should be made and studied before finally accepting recruits. Out of 15,576 deaths, 3,607 (23 per cent) were caused by tuberculosis, and the men averaged two years in hospital. This x-ray would, at the same time, give information regarding certain types of cardio-vascular disease, and there should also be a complete urinalysis. We know that many suffering from an incipient chronic disease, as well as others with a well established lesion, such as an aneurysm, were enlisted, to become pensioners at a later date.

Age.—It is probable that too much stress has been laid on enlisting the youth for service in the field, and the table below shows the numbers that enlisted at certain ages.

Under 18 years	9,336
Age 18 "	46,424
" 19 "	37,631
Total under 20 years	93,391

The study shows that those enlisting at the minimum age suffered a high death rate from disease, chiefly tuberculosis, and that the average age for the tuberculous pensioner is two years less than the average age for the whole pension group. This is a most significant finding. It is also known that those of minor years were the hardest to rehabilitate upon their return to civil life.

It might be suggested that the younger men be mobilized for the production of war materials and supplies. Thus they would in most respects lead the life of a civilian, release more mature men for service, and, incidentally, learn regular work habits and a trade.

The death rate from disease indicates that the after-effects of war service had a less adverse influence on the seasoned men of 30 years and over than on those 24 years and younger.

Tisdall, of Toronto, has shown that the calcium requirement at 17 years of age is 1,500 mg., whereas an average daily diet supplies approximately 500 mg. Leitch, of Scotland, has shown that a boy does not become an adult from the standpoint of calcium requirements until upwards of twenty-five years of age.

If we take calcium to mean all of the accessory foods (vitamins, mineral salts, etc.), I think it is evident that the army ration, while it was satisfactory from the standpoint of calories, would be sub-optimal, or in certain cases deficient, in the accessory food factors for many soldiers under twenty-four years of age. The high morbidity of tuberculosis among adolescents and in the 20 to 24 year age group is well known. Adolescence is the age of natural susceptibility, and nutritionists have shown that, particularly during the developmental stage, prolonged deficiency in one or more of the essential food elements will cause various types of serious disability, namely, malnutrition, neuritis, scurvy, rickets, and one of great consequence to an army, loss of resistance to infection. I quote herewith a paragraph from a communication received from Dr. Tisdall:

"There is no question that your observation is correct, namely, that if the diet of young Canadians, particularly before they are fully matured, and from the metabolism standpoint they are not mature until well over twenty years of age, is not adequate in all respects it will definitely interfere with their level of health and lower their resistance to disease."

It would, therefore, appear that in Canada, where the developmental stage of a youth extends well into the twenties, it may be bad

national economy to enlist for services in the field men under twenty-one years of age unless they appear to be fully matured, or unless certain precautions are taken, such as: (1) a ration suitable to the age; (2) a thorough physical examination, including x-rays of the chest and tuberculin reaction test. (In the event of these men coming up for pension rating it would be possible to establish whether or not the disease was an aggravation or incurred on service. This has been a most difficult decision to arrive at in the past).

Certain training schools for nurses have had valuable experience in respect to the high incidence of tuberculosis among the very young nurses in training, as well as the incidence of tuberculosis in the non-reactors to the tuberculin test. This experience should be kept in mind.

While it is difficult to state with any exactness the underlying factors leading up to the high death rate from disease among the younger soldiers, two possibilities present themselves.

1. *Contact*.—Army life increased the ratio of contact between the susceptible and the infective individuals, but, even accepting this fact, it is hard to reconcile the total increase in the death rate as being entirely due to this circumstance.

2. *Rations*.—We have factual evidence that the death rate of the young was excessive and greater than that to be expected from sheer contact alone. It, therefore, seems reasonable to assume, in the absence of other proof, that with the country on a war footing the army ration as provided during the Great War, while otherwise adequate, may have been deficient in the protective elements, and as a result contributed to the loss of man power by permitting the physical breaking down of many in the younger age-groups, and by increasing the difficulty of all ages to ward off infections. This view is strengthened by the fact that the deaths in question took place late in the war and immediately following demobilization, and consisted of men demobilized for unfitness and pensioned before hostilities had ended, and of others who died shortly after being discharged to pension at demobilization. In other words, those dying had been mobilized for a sufficient period of time in which, if the essential food factors were not supplied, there would be nothing to prevent a steadily progressive loss of resistance with subsequent pathological changes.

Selectivity and war-impairment.—It is known from the statistics of life insurance companies

that selectivity wears off in approximately five years, at which time a selected group of men return to the average for their age. It also appears that war impairment has its greatest effect close up to the event and probably wears off in about ten years. It would seem, therefore, that we have a sliding scale in two directions, first, the selectivity employed at the time of enlistment wears off; second, war impairment wears off, leaving in each instance, after a lapse of ten years, groups comparable with similar age-groups of the male population.

Trends.—During the nineteen years from 1918 to 1936 inclusive, total deaths among pensioners were 1.70 times the number to be expected by Canadian Life Table No. 1A (Males, 1931) in a population of the same age-structure, but the heavier mortality of pensioners has not been of constant amount from year to year. The ratio of actual deaths in each of the years 1918 to 1936 to the deaths to be expected by the Canadian Life Table shows a steady decline from 3.28 (the average of the three years 1918 to 1920) to 1.20 for 1936.

Several elements enter into this decline. First, the death rate per 1,000 population among the entire body of Canadian males, including war veterans, dropped from 11.5 in 1921 to 9.7 in 1936, the result of improving facilities for medical care, sanitation, and better public health procedures both for the veteran and the civilian. It is to be expected that the pensioners would share with the rest of the population this secular improvement in mortality. Apart from the foregoing the pensioner has in his favour excellent medical care and another element of great importance, partial if not total freedom from financial worry. It seems evident that many conditions for which pensions were awarded eventually proved to be curable, in that they became arrested and no longer influenced the expectancy of life, although still affecting the pensioner's capacity in the labour market.

Second, the most disabled pensioners died (chiefly from disease), in the early years of the record, leaving behind a healthier group. This is also shown in the disability records of insurance companies, one experience giving a death rate among disabled insured pensioners in the first year of their disability of 94 per thousand, declining to 33 in the fourth year of disability.

But these causes are secondary in importance to the effect of age. Pensioners becoming older

are thrown into ages in which their mortality is more favourable in comparison with the mortality of Canadian males.

Death rates by age.—The above result arises because the ratio of the mortality rates of pensioners to those of the general population is not constant from age to age. At ages 20 to 24, the pensioners have a death rate of 1,440 per 100,000 (Chart 3) against a general rate of 331 per 100,000, but the poor showing of the pensioners does not continue far in life; by ages 35 to 39 they have only double the mortality of the general population, and at 60 they are equal to it. After that, and to the end of the exposures available, they actually show a better rate.

It is thus plain that as the pensioners grow older there will be a tendency to an approach to general mortality independently of any improvement in age-specific rates. This is a principal cause of the apparently rapid improvement in pensioner mortality with time that is shown during the period 1918 to 1936. From the age-specific rates a life-table for pensioners has been made which is appropriate for the calculation of expected deaths in each year, and as we have seen the ratio of actual to expected deaths also decreases steadily through the period, but at a much diminished rate.

Causes of death.—The main causes of death which showed more than twice the normal incidence among pensioners during 1918 to 1936 were: tuberculosis, endocarditis, myocarditis, bronchitis, and pneumonia. The pensioners were normal in deaths associated with diseases of the arteries and veins, the lymphatic system, the digestive system, the genito-urinary system, and with cancer. They were lower than normal in rheumatic diseases, diseases of nutrition, etc., chronic poisonings and intoxications, arteriosclerosis, and appendicitis.

Changing incidence of the various causes of death during the post-war period.—The ratio of actual to expected deaths from Class 1 of the International List (88 per cent tuberculosis) declined more than from any other of the major causes between 1922 and 1936, from 4.32 at the early date to 1.16 at the later. All of the other causes also show a steady drop, though of smaller amount; in none does the ratio of actual to expected increase from 1922 to 1930, or from 1930 to 1936. The remarks which were made with reference to the effect of the rise in the average age of pensioners in causing an improve-

ment in mortality for "all causes" of death hold here, while the elements of improvement in general mortality and the dying of the more badly affected pensioners in the early days after the war, etc., are of appreciable importance. (The age factor enters to cause a very large part of the improvement in each of the causes separately, as it does for the total of "all classes").

Each of the causes of death, with the exception of tuberculosis, has a flatter incidence by age for the pensioners than for the Canadian male population. At the younger ages the rates for pensioners are higher, and, in general, at the older ages they are lower. In each of five principal causes of death it is possible to estimate roughly the age below which the 1930 to 1936 pensioners are more, and above which they are less, heavily affected than the general population.

Death rates by age and calendar year.—Between ages 20 and 50 (Chart 4) it is seen that the mortality rates of 1915 to 1924 are higher than those of 1925 to 1929, and the latter in turn are higher than the rates of 1930 to 1936. At the later ages there is very much less percentage difference between the three curves, and, in addition, the downward sequence for the younger ages is lost, for the first period rates are intermediate between the second and the last. At the youngest ages, further, though it is plain that the low level of the general population of Canada has not yet been reached, about two-thirds of the distance from the heavy rates of 1915 to 1924 down to the normal has been traversed.

It is interesting to note that between the civilian census of 1921 and that of 1931 there was very considerable improvement at the younger ages of life among males, but beyond the age of 55 there was, on the average, no improvement at all. Thus, the age-incidence of improvement in mortality among pensioned veterans reflects that of Canadian males as a whole.

The death rates "due to service" form a larger part of total pensioner death rates at the young ages than they do at the older. This is because in late life the degenerative diseases attack pensioners and general population alike with steadily increasing intensity, while death rates "due to service" are more nearly constant in age-incidence. An analysis by calendar year showed that in 1923 the "due" deaths were double the "not due", and that by 1936 they

had gone down to half. The absolute number of "due" deaths did not change greatly in the period, but the "not due" increased from 156 to 602.

Life-expectation of pensioners and general population.—Chart 5 shows the pensioned population during the years 1918 to 1936. It is plain that there have been very great fluctuations in the total number of pensioners. About 1921 a large number of men accepted gratuities and final payments, which eliminated them from the ranks until 1931 and 1932, when they were re-accepted as pensioners. If we assume that there will be no additions to the 79,789 pensioners who were on the books of the Department of Pensions and National Health at the end of 1936, and that the only decrement from the group is death, and we assume death rates in accordance with (a) the Canadian Life Table; (b) the Pensioners' Life Table 1918 to 1936, and (c) the Pensioners' Life Table 1930 to 1936, then we will have the lines given on Chart 5 for the projected population up to the time when the last survivor is dead—1996 on all bases. The three lines are very close to one another. In the years immediately following 1936 the Cana-

dian Life Table shows the largest number of survivors, the Pensioners' Life Table of 1930 to 1936 coming next, and the Pensioners' Table of 1918 to 1936, weighted as it is by the high mortality of the years immediately after the war, is the lowest. Undoubtedly the most reliable forecast of the three is the second projection mentioned, the Pensioners' Life Table of 1930 to 1936, which falls between the other two for a period of years, then rises and remains above the Canadian Life Table.

The area under each of these curves gives the total number of years which we can expect the pensioners to live after 1936. By dividing the area by the number of pensioners alive in 1936 we get the average years that will be lived beyond 1936 on the three tables of mortality. The Canadian Life Table gives 24.70 years, the Pensioners' Table, 1930 to 1936, 24.65, and the Pensioners' Table, 1918 to 1936, 23.70 years.

If we compare the excess of the expectation of life of the general population over that of the pensioners, as the latter is given by the specially constructed Pensioners' Life Table 1930 to 1936, we find that whereas the Canadian male in 1930 could look forward at the age of

DEATH RATIO (DISEASE ONLY) OF ENLISTED MEN,
1914-1919.

DEATH RATIO OF PENSIONERS SINCE DEMOBILIZATION.

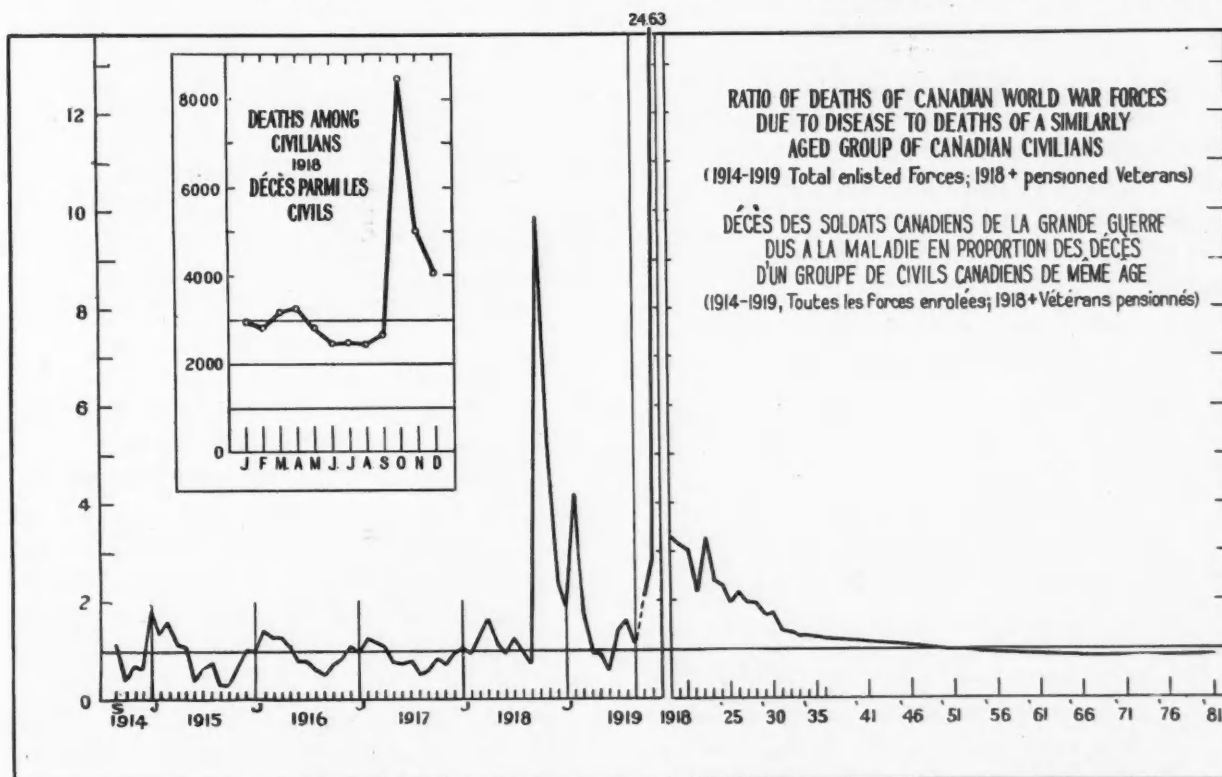


Chart 1.—This chart is in two sections. First it shows the death ratio from disease only for all enlisted men during the war. Second half.—The death ratio of pensioners only. This ratio is projected into the future on the basis of a life-table made on pensioner deaths from 1930 to 1936 inclusive.

32 to 38.82 more years of life, the pensioner had a prospect of only 37.24 years, or approximately a year and a half less, but this excess of the general population steadily decreases through life, and at the age of 52 the two expectations are equal, the higher mortality rate of the pensioner between 52 and 64 being counterbalanced by his lower rate after that date. At all ages greater than 52 the pensioner can look forward to a longer life, if the rates of the period of 1930 to 1936 are maintained. The average age of the pensioners today is 50 years. The answer to the question of pre-aging, that takes pensioners of all ages into account, is contained in the previous paragraph, where we saw that the average pensioner would have 24.70 years to live on the mortality of Canadian males, against 24.65 he showed in the 1930 to 1936 pensioners' mortality. An important consideration, however, is that, although the pensioners were a selected group at the time of their enlistment, it is well known to insurance companies that selection "wears off" in approximately the first 5 years of insurance, leaving behind a group of

average mortality. If one were asked to estimate the war influence, the probable answer lies in the downward trend of the first part of the B and C curves, as compared with the normal line, seen in Chart 4, but if we are concerned with the question of the cost of pensions to the present disabled World War veterans as compared with the cost for Canadian males a definite answer is obtained by comparing annuity rates. The average present value (as of March, 1938) of an annuity of \$50 per month to a random group of Canadian males similar in age-structure to the pensioners, would be \$9,458 per man; for the pensioners themselves (on their 1930 to 1936 mortality) it would be \$9,363, calculated in both cases at 3 per cent interest. It is plain that the present value of the cost for pensioners is not much lower than that for the general population. Since it is reasonable to suppose for the pensioners inferior vitality to the veterans as a whole, rates and projections on a similar basis for the latter, if such could be made, would probably show an even higher cost.

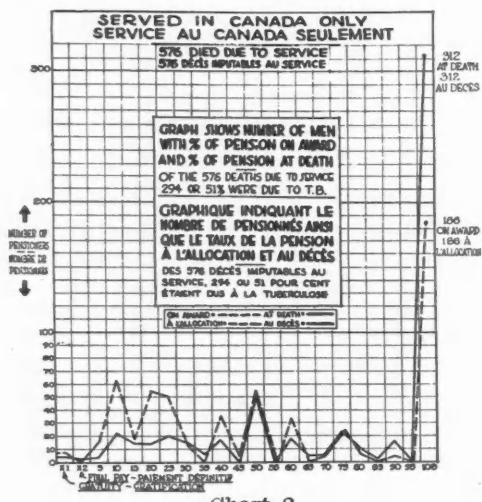


Chart 2

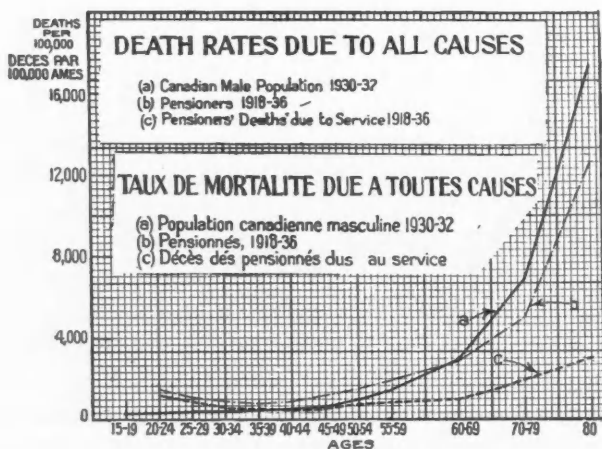


Chart 3

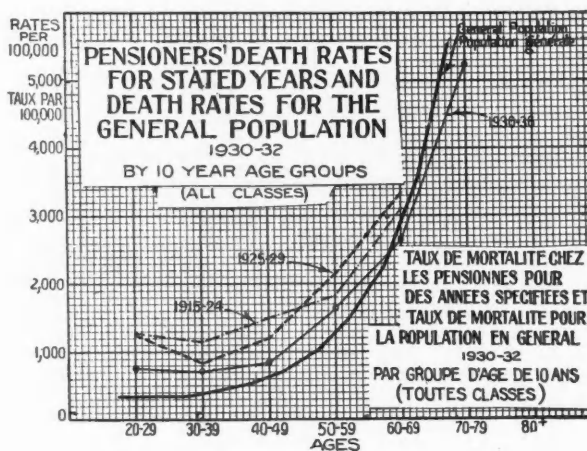


Chart 4

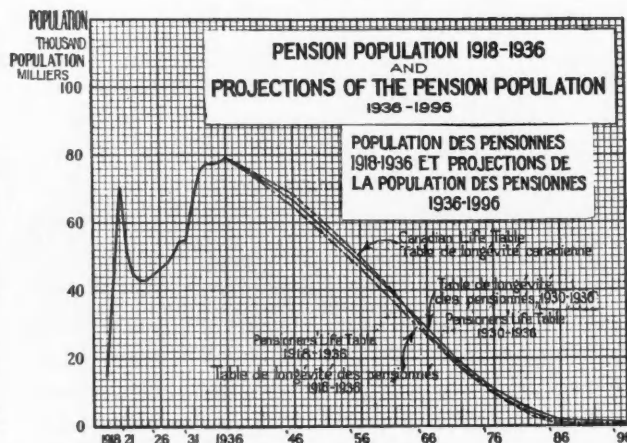


Chart 5

NOTE.—As originally submitted this paper was more comprehensive and contained a great deal of important material which we have regretfully had to withhold for lack of space. We understand that the Department will eventually publish the work in full in pamphlet form.—[Ed.]

Our thanks are due to Mr. M. C. McLean, Dominion Bureau of Statistics; the late Mr. W. R. Tracey, Dominion Bureau of Statistics; Mr. N. Keyfitz, Dominion Bureau of Statistics, who prepared the Life Tables, Death Rates, and Comments; and Dr. Frederick F.

Tisdall, Department of Pædiatrics, Hospital for Sick Children, Toronto, for charts.

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AN ADDRESS ON ASTHMA*

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AS time goes on more and more is known about the allergic state in man, thanks to the unremitting studies of many painstaking workers in this field. Because there is still much to learn we are apt to disparage the results attained so far, particularly in the field of treatment. Perhaps the most important recent advance in our knowledge of this condition has been the recognition of three major varieties of allergy. This differentiation has been based upon both clinical and laboratory studies. These varieties are: (1) atopy or atopic allergy; (2) bacterial allergy; (3) contact allergy.

ATOPIC ALLERGY

Atopy is best exemplified by typical cases of hay-fever, pollen asthma, or asthma due to a sensitivity to the protein of foods, animal emanations, or miscellaneous substances such as house dust, orris root, linseed, etc. Clinically these cases are characterized by attacks of coryza or asthma upon exposure to the offending substance, which attacks are prevented, and, where initiated, are relieved, by avoidance of such offending substance. From the laboratory standpoint they are characterized by a skin reaction of urticarial nature when such substances in soluble form are brought into intimate contact with the deeper layers of the epidermis by way of superficial scratches or by intradermal injection. Besides being of urticarial nature, this reaction is characterized by promptness, *i.e.*, it appears within the space of ten to twenty minutes and disappears in an hour or so. In contradistinction to other tests to be described

it may be designated as an "immediate" reaction.

BACTERIAL ALLERGY

It is well known that lesions due to bacterial infection may occur at sites in the body at some distance from the focus of bacterial infection, and that these lesions do not themselves harbour any bacteria. Such lesions occur in tuberculosis, syphilis, typhoid fever, scarlet fever, rheumatic fever, fungus infections and other conditions. It is believed that the focus of infection produces "allergizing" substances which escape into the blood stream and sensitize susceptible tissues in parts of the body remote from the focus. Subsequently these sensitized areas react to the circulating antigen, usually by the production of a sterile inflammation.

This bacterial allergy may be demonstrated by the intracutaneous injection of a sterile extract of the bacteria concerned. The Mantoux (intradermal) tuberculin test is an excellent example of this form of allergy. It will be noted that, in contradistinction to atopic allergy, the reaction is not "immediate", taking 24 to 48 hours to develop, and is not urticarial but inflammatory in nature. Asthma occurring in the course of a bacterial infection, as in bronchitis, sinusitis and more rarely in chronic cholecystitis, prostatitis, etc., is believed to be directly due to such bacterial allergy. The microorganisms in these cases are usually of the streptococcus-pneumococcus group.

CONTACT ALLERGY

Certain forms of occupational dermatitis, particularly of the hands, are due to an allergic

* Delivered before the Fifty-ninth Annual Meeting of the Ontario Medical Association, Section of Medicine, Hamilton, June 1, 1939.

condition. Some of these are due to a true atopic allergy and skin tests typical of that type of allergy are found in these cases to be positive. Thus we may have ragweed dermatitis, goose feather dermatitis, etc. More often, however, such tests prove negative, in spite of the fact that, clinically, the condition seems related to exposure to certain irritants. Thus the housewife finds that her dermatitis appears coincidental with acquiring a primula plant; the bank clerk begins to suffer when he is transferred to the cash where he handles nickel; the gardener finds his trouble occurs when he handles tulip bulbs.

If a small quantity of the moistened suspected material is placed upon the unbroken skin of a susceptible person and covered with adhesive tape to maintain the moisture and position for twenty-four to forty-eight hours a vesicular eruption will appear at the site of contact, similar to the early stages of the dermatitis from which the patient suffers. This is called a "patch test", and it will readily be seen that the reaction differs fundamentally from those described in atopic allergy or in bacterial allergy. In contact allergy, as this type is called, the only manifestations of the condition are found in the skin. Asthma and hay-fever are not encountered in this type.

Having described briefly the three main varieties of allergy, we may now go on to discuss the types of asthma not due to allergy, at least in the generally accepted sense of the term.

TYPES OF ASTHMA NOT USUALLY REGARDED AS DUE TO ALLERGY

Cardiac asthma.—In a small number of cases, probably as low as 1 per cent or less of all asthmatics, attacks having the general characteristics of bronchial constriction occur without evidence of allergy as described above, but with evidence of cardiac disease. The attacks are relieved by epinephrin and are properly classified as asthma. This type is to be distinguished from that commonly described in the cardiac literature as cardiac asthma, which embraces all cases of paroxysmal shortness of breath due to heart disease. The great majority of these cases have no bronchial constriction, are not relieved by epinephrin, and should properly come under the category of cardiac dyspnoea. True cardiac asthma is a decidedly rare condition.

Nervous asthma.—Not quite so rare, but never-

theless unusual, are the cases of asthma in which we can find no allergy, either atopic or bacterial, and no evidence of heart disease, but in which asthmatic attacks occur seemingly without cause. One finds that these patients invariably are of the "nervous" type and the attacks can be traced to episodes which have upset their mental poise. Business worries, domestic difficulties, shocks and frights frequently precipitate an attack of asthma. All we can say is that these people seem to have an unstable bronchial neuromuscular mechanism, what we might call an "asthmatic diathesis", and react to the stimuli by a paroxysm of bronchial constriction. The attacks are relieved by the usual bronchial dilators such as epinephrin, ephedrin and atropin.

Mixed cases.—Very frequently one encounters cases of asthma in which several causative factors operate to precipitate attacks simultaneously or at different times. This is especially true of long-standing atopic cases in which repeated or prolonged asthmatic states favour the development of bronchial infection which in turn causes bacterial allergic asthma as well. This type is well exemplified by the ragweed asthmatic whose symptoms persist into the late fall and winter due to secondary bronchial or sinus infection.

THE TREATMENT OF ASTHMA

The fundamental principle of all treatment should of course be the removal of the underlying cause, and that is the chief reason for presenting the etiological classification of asthma in the foregoing part of this paper.

In the case of atopic asthma removal of the cause may be attempted in two ways: (a) by avoiding the offending substance; (b) altering the specific sensitivity of the patient by inoculations with extracts of the specific antigen, or in the case of some foods by feeding small quantities of the offending substance. The first method is exemplified by those persons who migrate to the north during the ragweed season, who substitute Kapok pillows for feathers, who give away the dog, or who omit incriminated foods from their diet. The second method is practised by those who take pollen inoculations for hay-fever, who take injections of horse dander extract to enable them to ride, or who eat tiny pellets of hard-boiled egg in gradually increasing numbers to gain a tolerance for that food.

In bacterial asthma the history of the patient may be one of two main types— (a) frequent recurrences of acute upper respiratory infections which after a few days gradually extend to involve the trachea and bronchial tree; with this extension asthmatic attacks supervene; (b) there is a history of chronic bronchitis, secondary as a rule to chronic sinusitis, myocardial disease, emphysema, occupational hazards, climatic conditions, etc. It is obvious that removal of the cause in bacterial asthma involves an attempt to prevent or eliminate these conditions. Avoidance of contact with persons suffering from acute respiratory disease, of exposure to wet, cold, draughts, and chilling of the body surface, irritating gases and dusty atmospheres, may be efficacious. A change of residence, especially to a drier locality, or even moving to a dry warm climate in the winter, may result in freedom from attacks. Many patients experience marked benefit from a thorough course of inoculations with autogenous, or, in some cases, stock, respiratory vaccine, particularly if such treatment supplements a conscientious adherence to a regimen based on the principles enunciated in the earlier part of this paragraph. Foci of infection should be eliminated wherever practicable, and treatment of underlying condition such as myocardial disease, mitral stenosis, bronchiectasis, etc., instituted.

With reference to cardiac asthma, it is not possible in the compass of this paper to discuss this problem, other than to state that the treatment of the asthma is largely the treatment of the underlying heart condition. Where there is true bronchial spasm, treatment of the individual attacks does not materially differ from that of other forms of asthma and will be discussed presently.

Nervous asthma should be attacked from the standpoint of the fundamental make-up of the patient. A careful study of the habits of life, work, rest, recreation and social adjustment of the individual must be undertaken. Sources of irritation, local (physical) as well as environmental, must be discovered and eliminated where possible. A placid, "hum-drum" type of life is best suited to these people.

Apart from avoidance of specific allergens as mentioned above, the patient himself can do a great deal towards reducing the number of paroxysms he experiences. The asthmatic patient should regard himself, as Rackemann suggests, as a loaded gun. By careful analysis of

each attack he will discover that certain circumstances or episodes seem to "pull the trigger". For example, hurrying to catch the street car, eating a generous meal, stepping out into the frosty air, attending an exciting hockey match, or even indulging in a hearty laugh, will often precipitate an attack. By a careful study of each attack many such factors may be recognized and eliminated. All asthmatics should eat small meals and take some nourishment between meals.

The hypodermic injection of epinephrin (1-1,000), in amounts varying from 3 to 15 minims, remains the most effective method of dealing with the immediate attack. It is unusual for a dose of more than 8 minims to be necessary. Mild attacks may be relieved by the oral administration of ephedrin gr. $\frac{1}{2}$ (gr. $\frac{1}{4}$ in children). In an attempt to overcome the disadvantage of the hypodermic route for the use of epinephrin, the inhalation of concentrated (1 per cent) epinephrin from a special nebulizer has been used with considerable success in many cases. A French firm has placed on the market a pocket nebulizer and solution containing epinephrin in a concentration of $2\frac{1}{2}$ per cent. Several of my patients have reported satisfactory results from its use.

Last year Keeney¹ reported his experience with the parenteral injection of epinephrin in peanut oil. His object was to prolong the absorption time of a single injection of epinephrin in an effort to reduce the number of treatments necessary in a patient having frequent attacks of asthma. His preparation contained epinephrin in 0.2 per cent concentration, and he found that a single dose (intramuscularly) of 0.5 c.c. would frequently control the patient for 12 or more hours, whereas with ordinary 0.1 per cent epinephrin several injections were necessary in the same time. We have had some experience at the Toronto Western Hospital with this preparation, kindly supplied to us for experimental use by the Connaught Laboratories, and have obtained encouraging results in a small series of cases. In March of this year, Spain, Strauss and Fuchs² published their results with a 0.2 per cent solution of epinephrin in gelatin, designed also to prolong the effect of the drug. We have conducted a small series of experiments in an attempt to compare the effects with those of ordinary epinephrin solution. Our experience so far is too limited to enable us to speak with assurance, but it would seem to bear out in gen-

eral the claims of the originators that in cases of *status asthmaticus* the total number of injections may be cut down to two or three in 24 hours while maintaining the patient free of attacks. Patients in *status asthmaticus* may also be relieved in many instances by the intravenous injection of aminophyllin. We use 0.48 g. (7½ gr.) dissolved in 30 c.c. physiological saline given slowly (3 to 5 minutes).

Experience confirms the general belief that iodides tend to lessen the tendency to asthmatic attacks, and this drug, alone or in combination with others, may be used with benefit wherever there is a likelihood of the attacks occurring in more than isolated paroxysms. It may be dispensed in water, 10 gr. t.i.d., or, for example, in the following mixture:

Pot. iodidi.	—
Pot. bromidi aa	3 iii
Codeiæ phos.	3 gr. iv
Tr. hyoscyami	3 1 ss
Syr. sassafras co.	3 ii
Aqua ad	3 vi
m. sig. 3 ii ex aqua p.c. et h.s.	

SUMMARY

The various types of allergy are reviewed and their relation to asthma is indicated. Four main types of asthma are described.

Treatment, both specific and general, is dealt with. Emphasis is laid upon the importance of a careful study of the factors involved in each individual case.

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A METHOD OF BREECH DELIVERY*

By N. W. PHILPOTT, M.D.

Montreal

THE question of breech delivery is most important. First, because the fetal mortality is much greater in this type of case than in vertex deliveries; and, secondly, because many doctors are so concerned about the breech case that a Cæsarean section is in their opinion the only safe way out of the difficulty.

The incidence of fetal mortality ranges in different clinics from 15 to 60 per cent. Some of the better hospitals in America and in England report fetal deaths well above 50 per cent. It is agreed that this is too high a toll. We must therefore analyze the causes of death and then concentrate on the best form of delivery. Most of these babies die from the trauma of labour. In fact, there are two pathological lesions which far surpass all others in causing death. Intracranial hæmorrhage is the worst offender. Next in frequency are those lesions associated with central nervous system damage, caused by trauma in the base of the brain or in the cervical region; these are manifested by circulatory or respiratory disturbances.

We all know that these lesions are not so common in vertex cases. This is very plausible because the head is a much better dilator than the breech. When the vertex presents the cervix,

vagina and perineum are well dilated so that the after-coming body passes through with little or no difficulty. When the breech presents this is not true because the largest part comes last and the after-coming head will, so frequently, be obstructed by partially dilated soft tissue. This condition is even more pronounced when delivery is attempted before nature has been allowed to properly dilate the pelvic canal. It is then practically impossible to deliver the after-coming head without traumatizing the baby.

Today, as we have said, we often see doctors who are so frightened of the breech case, especially in the primipara, that they are recommending and are doing a Cæsarean section to avoid the delivery. This is subjecting the mother to a much greater risk than is justified. If the bony pelvic canal is adequate it is possible to deliver the baby without too much fetal damage. But, no doubt, many of you will ask how this is to be accomplished.

In 1933 Professor Fraser suggested that I take the subject of breech delivery as a special study. It was first necessary to analyze and investigate the different mishaps. Next it was necessary to find ways and means of cutting down the fetal mortality. There were many most interesting observations. May I bring some of these to your attention?

* A paper read at the Seventieth Annual Meeting of the Canadian Medical Association, Section of Obstetrics and Gynæcology, Montreal, June 21, 1939.

REPORT OF 776 BREECH CASES, 1929-39

		Percentage
Maternal deaths	3	0.38
Uncorrected fetal deaths	134	17.2
Monstrosities and deaths ante partum	42	
Corrected mortality cases	734	
Babies dying intra or post partum..	91	12.3

These are 776 consecutive breech deliveries in the Royal Victoria Maternity Hospital. Both the uncorrected and corrected figures compare most favourably with any other clinic in America or in Europe.

	No. of cases	Fetal deaths	Percentage
Frank breech	558	61	10.9
Footling breech	176	31	17.5
Impaction of breech (foot pulled down)	30	6	20.0
Active extraction	122	36	29.5
Bag induction (premature babies)	10	3	30.0
Forceps on after-coming head	95	9	9.4

There are a few points to emphasize. We found, as did many of our British confrères, that the fetal mortality is much higher in footling breech cases than in those which present as a frank breech. The more active extraction tends to increase fetal damage. In premature cases, where one is fearful that dilatation will not be adequate for the after-coming head, the use of a large Voorhees bag in the beginning stages of labour is most helpful. Where soft tissue dystocia is pronounced forceps on the after-coming head is strongly advised.

Since 1934 we have concentrated on breech delivery, with special emphasis regarding two principles; first, that the patient be allowed to have a delivery such as nature would deem advisable; secondly, that extreme care must be taken with the premature baby where the after-coming head is definitely much larger in diameter than any part of the body. For that reason I have divided the results of that period from 1929 to 1934 from those of 1935 to 1939.

1929 TO 1934		Percentage
Total cases	503	
Fetal deaths (uncorrected)	94	18.6
Corrected mortality cases	474	
Babies dying intra or post partum..	65	13.7
1935 TO 1939		
Total cases	273	
Fetal deaths (uncorrected)	40	15.0
Corrected mortality cases	260	
Babies dying intra or post partum..	27	10.3

By concentrating on breech delivery we have succeeded in lowering the fetal mortality by 3 per cent. The next table shows most definitely where this was accomplished.

1929 TO 1934			
	No. of cases	Fetal deaths	Percentage
Full term ..	403	31	7.6
8 months ..	44	11	25.0
7 months ..	27	22	81.0
1935 TO 1939			
Full term ..	189	16	8.4
8 months ..	40	4	10.0
7 months ..	31	9	29.0

During the last five and a half years I have succeeded in personally delivering 100 cases which have been breech presentations. It might be interesting for you to study these individual cases.

PERSONAL SERIES, 100 CONSECUTIVE CASES

	No. of cases	Percentage
External version	21	
Returned to breech	6	
Delivered as vertex	15	
Fetal death (cord about neck).....	1	6.6
Delivered as breech	83	
Impaction (foot pulled down)	9	
Fetal death—hydrocephalus	2	
Fetal death—intracranial hæmorrhage.	4	
Uncorrected mortality	6	7.2
Cæsareans (contracted pelvis)	2	2.0

These results were obtained by trying to imitate the natural mechanism as much as possible. External version was done with the patient fully conscious, and only when it was comparatively easy to turn the baby. It should be noted that only two Casarean sections were done.

Referring then to a moving picture, the author continued. This demonstrates that the baby is kept in a natural state of flexion only when the mother is allowed to have normal uterine contractions. Repeated small doses of sedative during the first stage of labour are advocated. When the breech comes in sight, nitrous oxide and oxygen should be given with each pain.

A wide episiotomy should be done when the breech dilates the vulva. If the patient is kept in a semi-conscious state the contractions recur at regular intervals and they are expulsive in character. Usually the mother will expel the fetus until the shoulders are in sight.

It is most important to support the baby in an upward direction; this allows the forces to act directly in the axis of the pelvis which tends forward and upward. Most men tend to pull the baby downward, thereby causing extension of the arms and head.

The after-coming head is delivered by pressure from above and by keeping the head well

flexed by means of one finger in the baby's mouth and another finger supporting the upper jaw. The head is allowed to be born slowly and by a rotary movement of its body and head up over the vulva and on to the mother's abdomen. If there is even a little obstruction offered by the vagina or perineum, forceps should be applied to the head.

In conclusion the points to emphasize are:

1. The normal mechanism should be intelligently imitated.
2. In cases of soft tissue dystocia the use of forceps on the after-coming head is strongly advised.
3. More attention must be focused on breech delivery in premature cases.
4. Masterly inactivity is not infrequently the safest procedure.

THE AMBULATORY TREATMENT OF FRACTURES*

BY ALEXANDER GIBSON, F.R.C.S.(ENG.)

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PROBABLY no department of surgical practice has been more consistently under the searchlight during the last few years than the treatment of fractures. Many factors are responsible for this. The greater number of industrial accidents, the universal use of the motor-car, have increased the quantity of material available for study; the improved quality of x-ray technique and the more frequent resort to the arena of the law-courts have urged a higher standard of attainment.

To a certain extent there has been a superficial conflict between the aim of the surgeon and that of the patient. The surgeon wishes the finest anatomical (and physiological) result; the patient wants to get back to his old job as quickly as possible. It is mainly the patient's desire to minimize the time of confinement that has led to the emergence of ambulatory methods. The surgeon has been quick to see that, provided certain precautions are taken, the result may be better anatomically and physiologically as well as economically.

What is meant by the term "ambulatory"? Strictly, it may mean any method by which the patient is enabled to walk about during the process of recovery. Thus, by the use of a paten on the shoe of the "sound" foot, and by using crutches or a walking calliper splint a patient with a lesion of one lower limb might be able to walk about. This is not what is currently meant by the term "ambulatory" however. It means the adoption of some method whereby the patient can walk about without crutches while making use of the injured limb.

THE PRINCIPLES OF FRACTURE TREATMENT

The principles of fracture treatment are simple and immutable. (1) The displaced parts must be replaced. (2) The replacement must be maintained until consolidation is complete. A fracture, however, must always be thought of in relation to the individual who has sustained it. A patient may remain disabled, unfit for work, many months after the fracture which made him a casualty has healed completely. Muscular contracture or peri-articular adhesions may prevent a man resuming his work as a tailor long after his fractured femur is solid. It is the rather tardy recognition of this fact that has led to a third postulate that is as important as either of the foregoing. (3) During the process of recovery there must be as little interference with the normal function of the part as is compatible with maintenance of the two principles just laid down. This third postulate recognizes the importance of damage to soft parts when a fracture occurs and the necessity for the resumption of function of the soft parts as speedily as possible. Now a muscle has movement as its essence. It must shorten and elongate to its full extent. Hence the problem is to permit as much movement of muscles and secondarily of joints as possible while maintaining the fractured bone at rest. It is obvious that if active use of the part is permitted the soft parts can exercise their normal influence on bone only when that bone is in perfect alignment; hence, active use of the part demands a more exact reposition of the fragments; further, it demands that retention of the fragments shall be more effective than if the limb is left in a state of passivity. Already, therefore, the de-

* Read at the Seventieth Annual Meeting of the Canadian Medical Association, Section of Surgery, Montreal, on June 21, 1939.

mand for more functional activity makes a call for more careful craftsmanship.

What methods are available for this double purpose? There are two groups, (a) operative; (b) manipulative.

If conditions be exact the use of metal plates can be relied upon to bring about a hair-line restoration of position in the majority of cases. The metal used in the plates is at present under scrutiny from the point of view of electrolysis; it is claimed that by employing vitallium this undesirable phenomenon may be avoided. With the renaissance of interest in the use of metal plates we are likely to have a series of disasters unless the most scrupulous technique is observed.

In order to avoid the risk of converting a simple into a compound fracture many methods of manipulation have been devised. In numerous cases, especially if seen shortly after the accident, manual manipulation is sufficient. In others, however, more force than can be exerted by the use of the hands is deemed necessary. This may be accomplished by adhesive traction applied to the skin; of recent years traction applied to the bone itself (skeletal traction) has been much in favour. This may be by "ice-tongs", Steinmann pins, or Kirschner wire, often combined with screw-traction. While these methods have an undoubted place it must never be forgotten that the prolonged presence of a foreign body in the neighbourhood of a joint exercises a deleterious effect on the periarticular tissues. Their employment as a method of reposition is not open to the same objection that attends their use as a method of retention.

For the purpose of securing immobility of the fragments during the process of healing and consolidation a great advance has been made by the application of plaster of Paris directly to the skin, or separated from the skin merely by a layer of stockinette. This is the procedure associated with the name of Bohler, of Vienna. When ideally applied this plaster gives excellent results. There are, however, several pitfalls. The position of the parts must not be altered during the process of hardening, or a fold may be formed in the plaster which is nearly certain to form a pressure sore. Again, if applied at all tightly, swelling of the limb distal to the plaster may be a cause for anxiety. This is generally obviated by splitting of the plaster case, or, better still, by elevation of the limb. There is, however, a more subtle danger. A plaster which fits perfectly today is not necessarily a perfect

fit in a week's time. The swelling due to the injury is likely to have subsided, and so the plaster is probably loose. This entails friction and pressure, and, more important, movement at the site of fracture. It is necessary, therefore, to keep careful watch and to change the plaster if it becomes too roomy. It is generally easy to recognize when anteroposterior or lateral movement is permitted, but a rotatory strain may easily escape notice. The details as to application of the plaster have been related so often that there is no need to repeat them here.

It is thus seen that the skin-fitting plaster is used for retention of the fragments. One of the reasons for non-union following plating operations in the hands of the inexperienced operator is that the plate is regarded as sufficient to maintain the re-posed fragments. If the plate is applied so as to secure perfect apposition, and after that plaster be used as carefully as if no plate were in position, the results would be more favourable. One suspects that some sins laid to the charge of electrolysis should more appropriately be attributed to movement.

SCOPE OF THE AMBULATORY METHOD

Upper limb.—Most upper limb fractures are treated with the patient ambulatory. From this point of view there is little to be said.

Vertebral column.—In the relatively frequent compression fracture of the body of the 12th thoracic, or 1st lumbar vertebra, the ambulatory method of treatment has scored one of its most striking successes. By means of hyperextension of the spine the crushed vertebral body can be brought into a condition radiographically almost indistinguishable from normal. When plaster is applied with the patient in the hyperextended position the patient is able to be out of bed within a few days of receipt of the injury. He is able to exercise the muscles of the back, and in many cases to attend to his business almost as well as before his injury. What this means to the morale of the injured man can hardly be over-estimated.

Lower limb.—The recent increase of interest in the treatment of fracture of the neck of the femur by the use of a metal nail is an indication of the trend towards permitting and encouraging function of the soft parts while healing of the fractured bone is taking place. One of the chief gains is avoidance of the stiff knee which so often followed the use of the Whitman plaster, a disadvantage which usually lasted many months, and was in many instances per-

manent. The immediate results of nailing of the hip are frequently so dramatic that there is perhaps a tendency towards risking more activity than is justified. It must never be forgotten that if weight is borne on the lower limb the strain at the neck of the femur is of a shearing character. Further, it must be kept in mind that even in the most favourable circumstances bony union cannot be expected in less than three to four months.

The shaft of the femur.—Quite a number of cases are on record of treatment of the shaft of the femur while allowing ambulation. I have no personal experience of the measure. In this procedure two strong pins are put through the shaft of the femur, but not sufficiently far to project beyond the shaft. These are above the site of the fracture. Two wires are passed clear through the shaft of the bone distal to the site of the break. Under careful guidance of the x-ray the displaced fragments are brought into alignment, the upper two "half-pins" are locked together by a connecting bar, and plaster is applied from the groin as low as the knee. It is too soon to estimate the value of the method.

Tibia and fibula.—A transverse fracture of both bones of the leg and a fracture of the fibula alone are the most suitable of all fractures for the ambulatory method. Most fractures about the ankle, the Pott's, the reversed Pott's, and the posterior marginal fracture can all be well handled while the patient walks about. The oblique fracture of both bones of the leg is not as a rule so suitable for this method. Unless the re-position is of hairline character, and the retention by plaster such as to allow no strain anteroposterior, lateral or rotatory, movement is very likely to be permitted, and this is certain to lead to non-union. In all fractures of the leg it is important to lay stress on the exact fitting of the plaster. The first plaster applied should be carried above the knee. At a later stage of progress, when swelling has entirely disappeared, inclusion of the knee is not necessary.

DANGERS

1. If alignment is imperfect then weight-bearing will tend to make things worse. This is notably so in the leg fractures where the slightest degree of backward bowing is detrimental to the functional use of the leg.
2. A plaster which is too short or too loose is sure to permit movement at the site of the break. In many cases this means non-union.

3. Gangrene from too tight application of the plaster is not unknown, and pressure sores resulting from incorrect application of the retaining plaster are also met with.

4. There are two other dangers not inherent in the method itself. One is that a patient may demand ambulatory treatment in cases not suitable, such as the oblique fracture of the tibia; the other is a tendency on the part of the attending surgeon to depend on the apparatus to absolve him from the duty of watchfulness.

ADVANTAGES

1. *Anatomical.*—A higher degree of exactness of reposition is demanded.

2. *Physiological.*—Function of the part is permitted almost from the beginning of treatment; there is less swelling, better muscle power.

3. *Economic.*—What these are can be most readily realized by considering the economic factors involving loss. (a) Loss of wages; it may be loss of a situation. (b) Cost of treatment; this includes hospitalization, and also the expensive after-treatment by baking, massage, short-wave therapy, and other similar measures allegedly beneficial. (c) Cost of compensation; this may be anything from total to some measure of permanent partial disability. As previously noted, it may be much more closely associated with the soft parts than with the fracture itself.

4. *Psychic.*—In many respects this is the most important of all. The patient who from near the beginning of his treatment has been able to walk around, and to do things for himself makes the full journey to recovery much more rapidly than one who has had impressed upon him his sense of dependence.

CONCLUSION

The use of ambulatory methods of treatment of fractures is of much value. It demands a more exacting degree of craftsmanship, involving at times operative interference. The fundamental principles of fracture healing must never be forgotten.

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PERFORATED PEPTIC ULCERS*

(ANALYSIS OF A SERIES OF 228 CONSECUTIVE CASES)

BY ALBERT ROSS AND CHARLES LETOURNEAU

Montreal

PERFORATION of a peptic ulcer, one of the most dramatic emergencies which confronts the surgeon, still ranks high among the causes of death, despite the increased knowledge and facilities which are at his disposal. Recent authorities on the treatment of this crisis are divided in their opinions regarding the procedure to be employed in obtaining the best results without increasing the mortality rate. This disagreement on the part of the various authors, all of whom report series of cases to prove their points, has prompted us to examine our own records in order to compare the various procedures which are used in the treatment of a perforated peptic ulcer.

A survey was made of 228 consecutive cases of perforated peptic ulcer, admitted to the Central Division of the Montreal General Hospital, from January 1, 1924, to February 1, 1938. All these cases were diagnosed as acute perforation of peptic ulcer. No cases of carcinomatous perforation were included, nor were cases of subacute perforation or penetrating ulcer taken into consideration. All of the cases studied were verified either by operation or by post-mortem examination.

The total mortality rate for the series was 20.6 per cent. Of the 228 patients admitted 8 died before they could be operated upon. In the remaining 220 cases which were operated upon there were 39 deaths, with a mortality of 17.7 per cent. A total of nineteen different surgeons took part in these operations. Three cases were noted to have perforated at some previous date, one of which was perforating for the third time. All had been treated by simple closure. Five cases were recorded in which a gross hæmorrhage had taken place at some date prior to perforation. These had received routine medical treatment.

Sex-incidence.—There were 12 females in this series, of whom 10 were diagnosed correctly, 1 diagnosed as acute cholecystitis, and 1 as pelvic

inflammatory disease. It is interesting to note that this last diagnosis also appears in Shawan's series. We found that 9 perforations occurred in the duodenum, on the anterior wall of the first part; 1 of which died; 2 were gastric, both of them fatal, and 1 was pyloric. This tallies not at all with the legend that perforations in females are predominantly gastric. The ratio (Table I) of males to females varies but slightly all over the world, according to the various clinics consulted. In the main, other authors report a slightly higher percentage of males.

TABLE I.
SEX-INCIDENCE

Sex	Number	Percentage	Ratio
Male	216	94.7	18
Female	12	5.3	1

The male incidence in other reported series was as follows: Shawan,⁹ 98.2 per cent; Thompson,¹⁰ 94.2 per cent; Judin,⁴ 97.2 per cent, Eliason and Ebeling,¹ 98.7 per cent.

Age-incidence.—The majority of perforations recorded in this series occurred in middle age. More than one-half of the patients were between the ages of 30 and 50 (Table II). The youngest was a boy of 18 years, while the eldest was 75 years of age, a female who died of coronary thrombosis 55 days after operation. The average age was 42 years.

TABLE II.
AGE-INCIDENCE

Age	Number	Percentage
Under 20	4	1.7
21 to 30	41	18.0
31 to 40	69	30.3
41 to 50	53	23.3
51 to 60	44	19.3
61 to 70	13	5.7
Over 70	4	1.7

Previous history of ulcer symptoms.—There was a definite denial of previous symptoms of peptic ulcer in 16 patients, while 49 had symptoms of less than 6 months' duration. These 2 groups were in no way related to age-periods.

* Read at the Seventieth Annual Meeting of the Canadian Medical Association, Section of Surgery, Montreal, June 22, 1939.

TABLE III.
PREVIOUS ULCER HISTORY (213 CASES)

Duration	Number	Percentage
Under 6 months	49	23.0
6 months to 2 years ...	35	16.4
2 years to 5 years	44	20.6
5 years to 10 years ...	40	18.8
Over 10 years	26	12.3
Indefinite	3	1.4
Negative history	16	7.5

Of the 197 patients who gave a history of peptic ulcer symptoms, 157 (79.7 per cent) were typical, having periodic pain relieved by food or alkalies. The remainder gave histories of various forms of dyspepsia. Thus, 57 mentioned gaseous eructations, 61 had attacks of periodic vomiting, with or without relief of pain, 11 had vomited small amounts of blood from time to time, and 27 had had tarry stools.

Moynihan and others have noticed that ulcer symptoms tend to become aggravated for a period of time prior to perforation. The pain is more intense and is no longer relieved by food or alkalies; nausea and vomiting are more frequent, and, in some cases, coffee grounds vomitus is noticed for the first time. There were 82 patients in this series (Table IV) who admitted such aggravation of symptoms before perforation occurred. The length of time before the crisis occurred was variable.

TABLE IV.
AGGRAVATION OF SYMPTOMS PRIOR TO PERFORATION
(82 CASES)

Length of time	Cases
10 hours to 10 days	47
10 days to 5 weeks	23
5 weeks to 3 months	6
3 months to 6 months	6

Distension of the stomach seems to have played a large part in the perforations of several of our cases. The consumption of quantities of beer, ranging from 1 pint to several quarts, consumed just prior to perforation, was recorded in 14 cases, while 6 patients perforated following the ingestion of a full meal. Three patients perforated while undergoing a barium roentgen-ray examination, 2 perforations occurred after taking purgatives, 3 were associated with heavy lifting, and 2 with trauma. In evaluating the causes of perforations Thompson¹⁰ mentions several of the above coincidences as possible contributing factors to perforation.

Diagnosis.—Although the diagnosis of the typical perforated peptic ulcer is relatively easy,

as some authors declare, the atypical cases are responsible for a large percentage of deaths through wrong diagnosis and the resultant delay in treatment. The following diagnoses (Table V) were recorded in our series.

TABLE V.
DIAGNOSES

Diagnosis	Cases	Percentage	Deaths
Correct	196	86.0	34
Appendicitis	13	6.1	0
Cholecystitis	5	2.1	4
Pneumonia	4	1.7	2
Coronary thrombosis	2		2
Intestinal obstruction	2		1
Cerebral accident	1		1
Acute bladder retention ...	1		1
Tuberculous polyserositis ..	1	4.1	1
Pelvic inflammatory disease	1		0
Carbon monoxide poisoning	1		0
No diagnosis	1		1
	228		47

These diagnoses were made, for the most part, soon after the onset of symptoms, and although several were subsequently corrected the delay involved may be considered to have reduced appreciably the patients' chances of recovery. Thus, 13 deaths (28 per cent) may be indirectly attributable to wrong diagnosis. Actually, some of these diagnoses which may appear far-fetched were, in fact, excusable in view of the signs and symptoms presented. Several cases went unrecognized for a long time in the presence of associated conditions which complicated the diagnosis.

SYMPTOMS

Pain.—The classical description of a sudden, stabbing, severe pain in the pit of the stomach was noted in 134 (59.2 per cent) cases (Table VI). In every case however, the onset of pain was sudden, but the location differed widely. The initial pain was reported in every abdominal region except the left upper quadrant. Radiation of pain, as an aid to diagnosis, was not recorded in a sufficient number of cases to be

TABLE VI.
LOCATION OF INITIAL PAIN (226 CASES)

Location	Cases	Percentage
Epigastrium	134	59.2
Right upper quadrant	16	7.0
Umbilicus	15	6.6
Epigastrium and right upper quadrant	9	3.9
Right lower quadrant	6	2.6
Hypogastrium	5	2.2
Chest	3	1.3
Left lower quadrant	1	0.4
Abdomen (not localized)	37	16.3



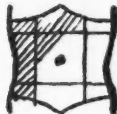



of much consequence statistically. Pain was transmitted from the location of onset to the right shoulder in 19 cases, to both shoulders in 8 cases, to the back in 9 cases, and to the left shoulder in 3 cases. Radiation of the "girdle" type was recorded in 3 cases. Instances of radiations to other regions were: chest (2), pubes and penis. The character of the pain was spasmodic in 27 cases, constant in 15, and unrecorded in the remainder of the series.

Nausea and vomiting.—The presence or absence of these features was recorded in 170 instances, and it will be noted (Table VII) that,

TABLE VII.
NAUSEA AND VOMITING (170 CASES)

Symptoms	Cases	Percentage
Nausea and vomiting	103	
Nausea and vomiting blood	11	
	114	67
Nausea and no vomiting	29	17
No nausea and no vomiting	27	16

TABLE VIII.
TENDERNESS (201 CASES)

Distribution	Cases	Percentage
Generalized	63	31.3
	51	25.3
	33	16.4
	20	10.0
	16	8.0
	13	6.4
	2	1.0
Absent	3	1.6


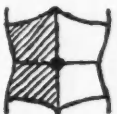


contrary to the contention of some authors, perforations may sometimes be accompanied by the vomiting of appreciable quantities of blood. This occurred in 11 cases. Cases where retching was noted were not considered to have vomited. This is emphasized because it is still thought by many that vomiting is rarely associated with a perforated peptic ulcer.

Other symptoms, such as the feeling of fullness, distension, diarrhoea, constipation, palpitations of the heart and other vaso-motor upsets were not mentioned often enough to be of any statistical importance.

PHYSICAL SIGNS

The abdominal signs most frequently encountered were those of generalized peritonitis, namely, generalized tenderness and rigidity. Thus, tenderness (Table VIII) was generalized

TABLE IX.
RIGIDITY (213 CASES)

Distribution	Cases	Percentage
Generalized	125	58.6
	36	16.9
	24	11.2
	17	8.0
	2	0.9
Absent	9	4.4

in 63 (31.3 per cent) of 201 recorded cases, while generalized rigidity (Table IX) was found in 125 (58.6 per cent) of 213 recorded cases. The distribution of tenderness and rigidity was sufficiently varied to obscure the diagnosis in many cases. It is easily seen that the atypical distribution of these two very important signs, coupled with atypical symptoms and indefinite histories, might well confuse the issue.

The presence or absence of liver dullness was noted in sufficient case reports to be of some diagnostic significance.

TABLE X.
LIVER DULLNESS (137 CASES)

<i>Liver dullness</i>	<i>Cases</i>	<i>Percentage</i>
Absent	85	62
Present	52	38

Signs of free fluid in the abdomen were noted in 59 (46.5 per cent) of 131 cases, and occurred mostly in cases where the perforations were of more than 8 hours' standing.

TABLE XI.
SIGNS OF FREE FLUID IN ABDOMEN (131 CASES)

<i>Signs of free fluid</i>	<i>Cases</i>	<i>Percentage</i>
Present	59	46.5
Absent	72	53.5

Leukocytosis.—In 180 instances a leukocyte count was done on admission to the hospital. The average was 15,000, while 70 per cent ranged between 10,000 and 18,000 cells.

TABLE XII.
LEUKOCYTE COUNT (180 CASES)

<i>Leukocyte count</i>	<i>Cases</i>	<i>Percentage</i>
4,000 to 9,000	25	14
10,000 to 13,000	54	30
14,000 to 18,000	71	40
19,000 to 40,000	32	16

Roentgenograms.—As an adjunct to diagnosis, films were taken in 19 cases only, 10 showing a subdiaphragmatic shadow, while 9 showed no shadows.

Other physical signs, such as rebound pain and rectal tenderness, were recorded in a few instances, too few to be of any positive statistical value. In accordance with the findings of other authors our series showed the temperature, pulse, and blood pressure to be unchanged, except in cases of long-standing perforation, where generalized peritonitis was well established.

LOCATION OF PERFORATIONS

As noted in other series of cases, the majority of perforations (84 per cent) occurred in the duodenum, located for the most part (Table XIII) on the anterior wall of the first portion, but by no means confined to this region. Other locations of interest were in the second portion of the duodenum, near the ampulla of Vater,

3 occurring on the anterior wall and 1 on the posterior wall; 5 other cases were noted to have perforated on the posterior wall of the duodenum, immediately post-pyloric. The pylorus was perforated in 13 instances, on its anterior wall, and was recorded as such only in cases where it was impossible to locate the pyloric vein. Gastric perforations took place most commonly on the lesser curvature, in the prepyloric area. Another fact, noted by many clinics, was also borne out by our series, when it was found that 91 per cent of the cases had perforations in the area around the pylorus. Double perforations were recorded in 4 of our cases, with 3 deaths.

TABLE XIII.
LOCATION OF PERFORATIONS (228 CASES)

<i>Location</i>	<i>Cases</i>	<i>Deaths</i>	<i>Mortality Percentage</i>
Duodenum:			
Anterior wall, 1st part	178	29	
" " 2nd "	3	0	
Posterior " 1st "	5	3	
" " 2nd "	1	0	
Not definitely located	5	1	
	192	33	17.1
Pylorus	13	3	23.0
Stomach:			
Lesser curvature, prepyloric..	13	6	
" " cardia	3	1	
Posterior wall	1	0	
Greater curvature, anterior wall	1	1	
Location not recorded	1	0	
	19	8	42.1
Double perforations	4	3	75.0

OPERATIVE PROCEDURES

With but 11 exceptions the operative procedures carried out in this series were divided into 3 types. Closure of the perforation, with an additional posterior gastroenterostomy, was the procedure employed in 120 cases, with 13 deaths; 26 perforations were closed and the peritoneal cavity drained, with 10 deaths; while

TABLE XIV.
OPERATIVE PROCEDURE (220 CASES)

<i>Procedure</i>	<i>Cases</i>	<i>Deaths</i>	<i>Percentage</i>
Simple closure	63	12	19.0
Closure and drainage	26	10	38.4
Closure and posterior gastroenterostomy	120	13	10.8
Drainage only	4	2	
Gastrectomy	2	0	
Judd pyloroplasty	2	1	
Closure, gastroenterostomy and drainage	2	1	
Posterior gastroenterostomy and drainage	1	0	
	220	39	17.7

TABLE XV.
COMPARISON OF PROCEDURES ON TIME-ELAPSED BASIS
(220 Cases)

Procedures	Under 8 hours		8 to 16 hours		16 to 24 hours		24 to 48 hours		Over 48 hours		Total		Percentage
	C	D	C	D	C	D	C	D	C	D	C	D	
Simple closure.....	39	4	10	1	3	2	5	3	6	2	63	12	19.0
Closure and drain.....	7	0	5	1	3	2	4	3	7	4	26	10	38.4
Closure and posterior gastroenterostomy	80	4	15	1	5	3	9	3	11	2	120	13	10.8
Drainage only.....									4	2	4	2	
Gastrectomy.....									2	0	2	0	
Judd pyloroplasty.....			1	1					1	0	2	1	
Closure, posterior gastroenterostomy and drainage.....					1	1			1	0	2	1	
Posterior gastroenterostomy and drainage									1	0	1	0	
Totals.....	126	8	31	4	12	8	18	9	33	10	220	39	17.7

63 were simply closed without drainage, with 12 deaths. Other procedures, carried out in isolated instances, are enumerated in Table XIV. The total operative mortality was 17.7 per cent. Latterly, following the trend of the literature, simple closure without drainage has been the most frequent operation.

COMPARISON OF RESULTS

Table XIV speaks for itself. The mortality rate of the series in which closure and gastroenterostomy were performed is definitely and materially lower than that of the other two series. The natural response to this finding is to say that the cases were selected, and that all the poorer risks were simply closed without further interference. This was true in a few cases, but not in sufficient frequency to account

for the discrepancy in the mortality rates. It is almost an axiom that the mortality rate must necessarily depend upon the general condition of the patient at the time of operation. This, for obvious reasons, cannot be determined from any records. We must, therefore, employ other criteria as a basis for the comparison of our results. It is now generally accepted by surgeons that the patient's chances of recovery are inversely proportional to the time elapsed between perforation and operative interference. It is also generally agreed that the operative risk increases with age. Employing these two most important of many variables as an indication of the patient's condition at the time of operation, we find that there was no general attempt at selection of cases. On the basis of the time elapsed between perforation and operation it is

TABLE XVI.
COMPARISON OF PROCEDURES ON AGE BASIS
(220 Cases)

Procedures	Under 20 yrs.		21 to 30 years		31 to 40 years		41 to 50 years		51 to 60 years		61 to 70 years		Over 70 yrs.		Totals	
	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
Simple closure.....	2	0	11	0	17	2	16	4	10	3	6	3	1	0	63	12
Closure and drain.....	0	0	4	0	4	0	8	4	6	4	3	2	1	0	26	10
Closure and posterior gastroenterostomy.....	2	0	24	1*	41	5	26	2	20	2	5	2	2	1†	120	13
Drainage only.....					2	1	1	0	1	1					4	2
Gastrectomy.....			1	0					1	0					2	0
Judd pyloroplasty.....			1	0					1	1					2	1
Closure, posterior gastroenterostomy and drainage.....					1	1	1	0							2	1
Posterior gastroenterostomy and drainage.....					1	0										

*Died of bilateral tuberculous pneumonia.
†Died of coronary thrombosis, 55 days after operation.

found (Table XV) that the mortality rate was uniformly lower with closure and posterior gastroenterostomy than with simple closure, either with or without drainage, in all the time periods considered.

Similarly, if we consider the age-periods of the various cases in our series, we note that the mortality rate is not increased in any particular period by the performance of a posterior gastroenterostomy in addition to a simple closure of the perforation (Table XVI).

COMPLICATIONS

The incidence of complications which followed the various procedures (Table XVII) is worthy of note. Oddly enough, pulmonary complications were the most frequent, occurring in 41 cases. Peritonitis appeared in 28 instances, while sub-phrenic abscesses supervened in 12 cases. Wound infections were recorded in 19 cases.

TABLE XVII.
COMPLICATIONS (209 CASES)

	63	26	120
Complications	Closure	Closure and drain.	Closure and gastroenterostomy
Pulmonary	13	7	21
Peritonitis	11	8	9
Subphrenic abscess	5	1	6
Wound infection	6	2	11
Embolus	1	0	2
Gastric hæmorrhage	1	0	1
Pelvic abscess	1	0	1
Duodenal fistula	1	0	0
Meningitis	0	0	1
Otitis media	1	0	0
Intestinal obstruction ..	0	0	1
Scarlet fever	1	0	0
Thrombo-phlebitis of leg	0	0	1

Pulmonary complications included lobar pneumonia, bronchopneumonia, lung abscess, tuberculous pneumonia and pulmonary infarction. Comparison of the three main procedures employed in the treatment of these cases fails to show any relative increase in the complications following a supplementary gastroenterostomy.

CAUSES OF DEATH

Death came to 15 patients by way of bronchopneumonia, in several cases superimposed upon a peritonitis; 10 succumbed to uncomplicated peritonitis; the remainder made their exit in various ways (Table XVIII).

TABLE XVIII.
CAUSES OF DEATH (39 CASES)

Causes	Cases
Bronchopneumonia	15
Peritonitis	10
Lobar pneumonia	6
Embolus	3
Gastric hæmorrhage	2
Tuberculous pneumonia	1
Lung abscess	1
Meningitis	1

POST-MORTEM EXAMINATIONS

Of the 39 persons who died following operative interference 31 were examined post mortem. These examinations, which established the causes of death, revealed further (Table XIX) that not a single death occurred as the result of a ruptured gastroenterostomy wound, although in two cases the gastric wounds were macerated and on the point of breaking down.

TABLE XIX.
POST-MORTEM EXAMINATIONS

Deaths	47
Autopsies	39
Autopsies on post-operative cases	31
Closures	15
Intact	10
Broken down	5
Gastroenterostomies	13
Closure intact	11
Closure broken down	2
Suture line intact	11
Suture line macerated	2
Drainages	2
Judd pyloroplasty	1

CONVALESCENCE

Improbable though it seems, the average convalescence (Table XX) of patients who had been subjected to gastroenterostomies was 3.5 days less than in those cases where simple closures were done, and 4 days less than where closure and drainage was employed. Latterly,

TABLE XX.
CONVALESCENCE (175 CASES)

Procedure	Cases	Days
Simple closure	51	28.5
Closure and drainage	16	29.0
Closure and posterior gastroenterostomy	108	25.0

in conformity with other clinics on this continent, it has been the tendency in this series to favour simple closure without drainage in treating perforated ulcers. Nevertheless, the excellent results reported in European clinics, as

outlined by Judin,⁴ Graves,³ and others, who favour major operative interference at the time of perforation, cannot be overlooked. The chief objection to the major procedures at the time of perforation seems to be that the trauma of operation, added to the shock which results from the perforation, might lessen the patients' chances of recovery. It has been pointed out many times, especially by Moynihan,⁸ that surgical shock, as evidenced by changes in temperature, pulse and blood pressure, is not present at the time of perforation. Certainly, our records would indicate that shock was not a deterrent factor to the major procedure. As regards the spread of infection in the major procedure, it will be noted (Table XVII) that the incidence of peritonitis was less frequent in those cases which were subjected to major surgery. Moreover, Mondor and Lauret⁷ have demonstrated that the peritoneal fluid rarely gives a positive culture in the early hours following perforation of a peptic ulcer, and have found the fluid sterile even 32 hours after perforation.

While it is admitted that the results of a small series such as this do not necessarily prove very much, it should be noted that there are other comparable figures. Judin⁴ reports equally low mortality rates for gastrectomies. In a series of 418 cases, over a period of 2 years, he shows a mortality of 12.8 per cent. Graves,³ surveying the published reports of the German clinics, notes similar results from both gastrectomies and gastroenterostomies done at the time of perforation.

That the mere suturing of a perforation does not cure the ulcer has been ably shown by Lewisohn.⁵ The ulcer and its symptoms persist, and in many cases perforates again, as did 3 in our series. While we do not advocate gastroenterostomy as the operation of choice in the treatment of all acute perforations we believe that there is sufficient evidence available to justify the course of those surgeons who feel that by doing a major operation at the time of perforation they may effect a permanent cure for their patients, and thereby spare them the ordeal and expense of further operative interference.

SUMMARY

1. Two hundred and twenty-eight consecutive cases of perforated peptic ulcers were analyzed; 220 were treated by operation with a total mortality of 17.7 per cent, including deaths from all causes.
2. Males outnumbered females 18 to 1.
3. More than one-half (53.6 per cent) of perforations occurred between the ages of 30 and 50 years. The average was 42 years.
4. Only 7.5 per cent of the cases gave an absolutely negative history of peptic ulcer.
5. The diagnosis was correct in 86 per cent of cases.
6. The onset of initial pain occurred in the epigastrium and right upper quadrant in 70 per cent of cases.
7. Nausea and vomiting accompanied perforation in 67 per cent of cases.
8. The commonest physical signs noted were generalized tenderness and rigidity.
9. The leucocyte count was between 10 and 18 thousand in 70 per cent of cases.
10. Ninety-one per cent of cases perforated in the area around the pylorus.
11. In this series of unselected cases closure and posterior gastroenterostomy without drainage gave a lower mortality than simple closure, both with and without drainage.
12. Autopsies revealed no post-operative deaths attributable to a broken-down gastroenterostomy wound.
13. Complications were no more frequent following gastroenterostomy than after simple closures.
14. Average convalescence following gastroenterostomy was 3 to 4 days shorter than that following simple closure.

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MALIGNANT TUMOURS OF THE COLON AND RECTUM*

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CARCINOMA of the colon and rectum occurs about as frequently as carcinoma of the stomach. The recognition of malignancy of the colon and rectum is relatively simple, and with modern diagnostic methods should be established at a much earlier stage than obtains at the present time. The prognosis after operative intervention in malignancy of the large bowel is better than that of carcinoma of the stomach. If an individual survives operation he has at least a 50 per cent chance of being cured. The question of operative intervention depends upon the stage in which the neoplasm is diagnosed. With a rise in operability the percentage of mortality may be increased, but more patients will be alive at the end of a three- or five-year period. The anatomy and lymphatics of the large intestine and rectum determine the operative technique to be applied.

The symptomatology constitutes a triad: (1) changes in bowel rhythm and function; (2) pain; (3) blood. Add to these the barium colon enema and proctoscopy, the barium x-ray series, and a physician has all the means necessary for an accurate diagnosis. In malignancy of the rectum and recto-sigmoid the palpating finger and a proctoscopic examination can, with extremely rare exceptions, make a positive diagnosis.

The apprehension in regard to colostomy is not justified: the patient with a colostomy can live a relatively normal life, with minor disabilities, if he is educated in the care of his colostomy, and no complicated bag or apparatus is necessary in the case of a colostomized patient.

A malignant growth in any portion of the gastrointestinal system is a surgical condition of major importance. Curability of cancer varies inversely with the duration of the neoplasm. An inquiring mind is somewhat surprised in looking over the operative material of any general hospital service to notice the frequency with which an operation is scheduled

under the designation "exploratory laparotomy for ulcer, or gall bladder disease, or appendicitis". At the same time one fails to find a similar designation, such as exploration for sigmoidal tumour. The alertness of the profession to suggest an exploratory laparotomy for diseases of the colon and rectum is not comparable with the scientific curiosity manifested in regard to diseases of the stomach, gall bladder or appendix. Again, the community is sensitized by medical and lay publications in regard to cancer of the stomach but not for neoplasms of the colon or rectum. An all-embracing sense of prudery and false modesty has been responsible for a lack of self-interest in regard to malignant growths of the large bowel. It may be stated, I think without much fear of contradiction, that malignant conditions of the colon and rectum are recognized at a much later stage of their development than are similar lesions in the stomach and pylorus. It is not that there is any inherent difficulty in the diagnosis of large bowel tumours as opposed to those of the stomach, for the diagnosis of the one type is certainly as precise as that of the other.

For purposes of surgical discussion the large bowel and rectum may be divided into three definite anatomical portions, namely, (1) the "right colon"; (2) the "left colon", and (3) the recto-sigmoid and rectum.

The localization, the biology of growth, the element of obstruction, the degree of cachexia, the rate and extent of local growth and metastatic extension, and the inherent malignancy of the cancer cell vary with the three portions just designated.

In the cæcum or ascending colon we have a portion of the colonic system that is given over to the absorption of fluid, and has the greatest cubic capacity of any portion of the large bowel. Growths involving the "right colon" tend to grow in all directions, as flat, sessile neoplasms, with rather wide excavations. They grow locally over variable periods of time, they metastasize slowly, and the intrinsic malignancy of the cancer cell is, if anything, much less

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than in any other portion of the large bowel.

Obstruction in the cæcum is rare, and the patient will many times palpate a tumour through the abdominal wall before there is any gross manifestation of obstruction. As the incidence of localization moves from the cæcum toward the "left colon" the degree of frequency of obstructive symptoms increases, as does the inherent malignancy, as well as the metastatic involvement.

There is one outstanding symptom of right-sided malignant growths that stands out with singular distinction; this is the surprising degree of anæmia which attends them in this part of the colonic system. So noteworthy is the anæmia that a patient in the third or fourth decade of life presenting an anæmia not unlike the early stages of pernicious anæmia might on observation be suspected of having either a pernicious anæmia or a malignant growth in the pyloric end of the stomach or of the right-sided colon. In malignant tumours located in the right colon there is a continuous seepage of blood. It seldom assumes an amount sufficient to give frank blood, or even to suggest tarry stools, but there is at all times blood leakage which by its continuous character, day after day, leads to a progressive and continuing loss of hæmoglobin and red blood cells. It has been the author's experience to note this outstanding characteristic in patients at a time when the symptoms had not been sufficiently declarative to suggest to the patient the desirability of a diagnostic survey.

With the localization of tumours in the left half of the colon the tendency to obstruction becomes increased, usually without the development of the anæmia or the cachexia. In fact, one is impressed with the relatively good general bodily condition of a person with a malignant tumour in the sigmoid. Carcinoma of the sigmoid is many times discovered accidentally in the course of gynæcological operations, or among nurses, technicians and doctors who, seeing an accidentally discovered malignant lesion of the colon, go to the x-ray department to have a barium colon enema.

Sigmoidal malignant growths do not have a continuous seepage of blood, but about 70 per cent of them exhibit occasionally frank blood by the rectum, with a considerable increase in the mucous content of the stool. This symptom appears usually before the development of definite obstructive symptoms.

From a surgical point of view the recto-sigmoid should be considered with the rectum as a definite anatomical division. Tumours involving this segment of the gut tube manifest varying degrees of obstruction, almost always have some frank blood, with frequency of bowel movements, vary widely in their potential malignancy, spread circumferentially, and metastasize early and extensively.

There are four main types of tumour in the rectum and recto-sigmoid: (1) the papillary carcinoma; (2) the adenomatous carcinoma; (3) the colloid; and (4) the melanotic carcinoma. The index of malignancy and ease of metastasis varies from the papillary to the melanotic carcinoma. Melanotic carcinoma fortunately represents less than 2 per cent of all malignant tumours of the recto-sigmoid and sigmoid, and is incurable.

Signs and symptoms of malignant growths in the large bowel may be canvassed as (1) symptoms of general bowel disability; (2) symptoms of specific localization of the tumour. The majority of people, even with or without a cathartic habit, have obtained a so-called intestinal rhythm which is personal to them, and over long periods of time is a habitual expression of their bowel function. If such begin to have a slight deviation from the heretofore normal and habitual bowel rhythm it calls for investigation. While an increase in the dosage of cathartics or a change from one cathartic to another may not call for any particular emphasis there is, however, in varying degree some disturbance of rhythmicity of bowel function in those with malignant disease of the colon. There is an increase in borborygmus and the development of painful peristalsis. One is impressed in an analysis of a series of cases of malignant tumours of the colon with the fact that there have been in some degree and for a considerable period of time cramp-like pains preceding defæcation.

The pristine description of malignant conditions in the colon, usually found in surgical textbooks, of increasing constipation, has not been evident in our cases. Of great value, however, has been a statement by the patient that following a meal there arise some painful intestinal cramps with a desire to move the bowels, and the nearer the tumour is to the anus the more pressing becomes this urge and the more forceful is the effort, but with marked diminution in the quantity expelled.

The symptoms of specific localization are few but dramatic. About 20 per cent of those who come to operation for carcinoma of the rectum and recto-sigmoid have been operated upon for hæmorrhoids. This is about the same percentage of accidentally discovered sigmoidal tumours in the course of laparotomies. In tumours that are confined to the rectum and recto-sigmoid there is frequency of bowel movement. If one inquires of the patient if he has had diarrhoea a negative answer will ordinarily be given, but if the question is framed "how often do you go to the toilet to empty your rectum or lower bowel?" the answer will be that he goes quite frequently to expel a small quantity of stool, mucus with blood, and that this is expelled with considerable force. It is the adventitious mixture of blood and mucus with some stool and the increased irritability of the rectum that produce the desire for the evacuation of small amounts of rectal contents.

A history of change in bowel rhythm, plus cramp-like pain, recto-perineal pain, and the occasional or continuous passing of blood-stained material, represents a trinity of symptoms strongly suggesting rectal carcinoma. Probably in no field of surgical diagnosis are the possibilities of accuracy of diagnosis so precise as in tumours involving the rectum. With the index finger in the rectum and the patient squatting and pressing down it is possible to feel at least 75 per cent of rectal tumours, and with a sigmoidoscope nearly all of the other 25 per cent may be made visible, and a biopsy may be readily obtained by using a rectal biopsy punch.

Roentgenological examinations for tumours of the rectum fail in about 25 per cent of the cases. The barium mixture will flow from the anal orifice upward past the obstruction, and filling the overhanging loops of sigmoid will obscure any luminal defect.

The location of tumours in the rectum and recto-sigmoid is as follows: recto-sigmoid 67 per cent; the ampulla 31 per cent; the anus 2 per cent. It is an arresting fact that carcinoma of the rectum is more readily diagnosed than any other type of colon tumour, and yet it tends to metastasize more readily and its curability is less than in malignant lesions of the upper portions of the bowel. Rankin found, on analysis of his post-operative results, that of his patients without glandular involvement 66 per cent were alive after resection of the cæcum, 56 per cent after resection of the descending colon and sig-

moid, and 48 per cent after resection of the rectum; and of the patients with glandular involvement 39 per cent were alive after resection of the cæcum, after resection of the descending colon and sigmoid 29 per cent, and of the rectum 20 per cent.

In malignant growths of the rectum it seems almost axiomatic that the smaller the tumour, the more rapid the metastasis and the more extensive the extra-luminal extension, and the more doubtful the prognosis.

Occasionally the surgeon is consulted by a patient with an enlargement of the inguinal glands and finds that the primary source of the adenopathy is an anal carcinoma. The curability of carcinoma of the large bowel depends in a large measure upon operability. The late Dr. Jones, of Boston, asked the question "Shall we operate only upon those patients whom we think we can cure, or shall we operate upon all patients whom we think we can make comfortable mentally and physically for one or more years?"

Operability means the selection of an individual for surgical intervention because his growth is operable from the standpoint of expecting a complete surgical removal. Therefore the number of operable patients in any community will depend in a large measure upon "colon consciousness" of the patients and the family physician. Where colon clinics have been established operability has increased from a low 20 per cent to as high as 60 or 65 per cent. Suppose we take 100 patients with a malignant growth in the large bowel, and after consideration we come to the conclusion that only 20 of them are proper subjects for surgical intervention with any hope of cure; the operability is 20 per cent. Let us estimate that if these 20 persons are operated upon and the surgeon has a 10 per cent mortality; 2 die and 18 survive. Further, on the basis that one-third at least of those who survive surgery will be alive at the end of 5 years, with an operability of twenty, 6 are alive and free from their disease at the end of 5 years. Let us suppose that a second group of 100 seek surgical relief, and of these 40 are operated upon. We increase the mortality, let us say, to 20 per cent; 8 have therefore died as the result of surgical intervention and 32 have survived. One-third of these on the same basis will be alive at the end of 5 years, so we have with an operability of 40 a higher hospital mortality but double the number of patients alive at the end of 5 years. There-

fore, curability and the saving of life are entirely dependent upon early diagnosis and increasing the percentage of operability.

From our undergraduate days the so-called "ribbon stools" have been held to be of considerable importance, but in my own experience they have had no diagnostic value. In an obstructive lesion of the sigmoid which still permitted the passage of faecal material there would obviously be an accumulation of the stool in the ampulla of the rectum, and the form of the stool would depend upon its consistency and the state of tonus of the sphincter.

Treatment of the patient with a malignant growth in the large intestine must embrace general and symptomatic measures as a preliminary to any surgical intervention. His age, his debility—chronic myocarditis, hypertension, nephritis, diabetes, and his anæmia—should be surveyed, appraised and treated.

The local effect of the malignant growth upon the proximal bowel is a matter of the utmost importance. Five per cent of those with malignant disease of the colon enter hospital with acute obstruction and operations for acute obstruction are fraught with an extremely high mortality. A neoplasm does not necessarily have to produce complete occlusion of the bowel to bring about widespread changes in the proximal portion; hypertrophy takes place above a partial obstruction. Inflammation of the bowel muscle, with œdema, ensues, and a suture passed through such a bowel is prone to leak, and leakage is probably the most consistent cause of peritonitis after primary resection and suture.

The outstanding indication in most cases is for decompression of the proximal bowel. Decompression may be accomplished by either medical or surgical measures. If the patient is not in a state of acute obstruction graduated medical means will in most cases be successful. The daily irrigation of the lower bowel with 2 per cent solution of Epsom salts, or 10 c.c. of tincture of quassia to 2,000 c.c. of water, plus the instillation of four to six ounces of olive oil into the rectum at night, will do much to assist the siphonage of material from above the obstruction. Small doses of Epsom salts by mouth, for the purpose of increasing the fluidity of the bowel contents; the giving of tincture of opium or paregoric to allay peristalsis; and the prescribing of a bland, high calorie, non-residue diet will, under careful watching and nursing, do much to accomplish decompression. When

local measures fail, or when the patient is in a stage of nearly acute obstruction, or the obstructive element is the major phenomenon then recourse must be had to cæcostomy or various types of colostomy proximal to the neoplasm.

In the majority of our cases we have employed cæcostomy, and in the last year have had occasion to vary the procedure with a Devine colostomy of the right transverse colon. This latter decompression operation gives the intestinal portion distal to the colostomy complete divorcement from faecal contents, and allows direct treatment of the distal loop. This type of colostomy is tolerated with very little discomfort to the patient, and its closure subsequently is relatively simple.

The surgical approach to any malignant tumour of the large bowel or rectum begins with the basic idea of a complete resection of the growth, and the entire gland-bearing area and, therefore, the individual operation selected depends entirely upon the localization of the tumour. In the main, the following steps are carried out: (1) mobilization of the bowel; (2) the resection of the tumour; (3) the re-establishment of colonic continuity, either at the time of the first operation or preferably after an interval; (4) operative procedures demanding permanent colostomies, with a resection of varying amounts of the terminal portion of the alimentary canal, including the anus.

In malignant lesions of the rectum my experience with segmental resection and preservation of the sphincter has been uniformly bad, and with no single five-year cure. Two patients lived for three years and one, approximately eight months. All had recurrence in the perirectal tissues and all died from cancer. I feel warranted in believing that preservation of the sphincter in carcinoma of the rectum is purchased by a definite and positive recurrence. I no longer consider it a desirable operation, and do my best to persuade patients not to contemplate it.

There remain for consideration for tumours of the rectum the Miles' abdomino-perineal resection and the posterior resection of Lockhart-Mummery. Both have an undoubted place. Both demand permanent colostomies, and the operations are not interchangeable. Differences of opinion prevail as to whether an abdomino-perineal operation should be done in one or two stages. Considered opinion seems to incline more to the one-stage operation, and my per-

sonal preference is for this. It has been my experience that many times the adhesions are so great that the second stage of the operation was more difficult than if the operation had been performed *in toto* at the first stage.

The posterior resection of Lockhart-Mummery, with excision of the coccyx, I have reserved for the obese and debilitated, and is performed only after the colostomy has been fully established for at least two weeks.

The operability in posterior resection has, in our experience, been less than in the abdominoperineal operations, while the mortality is about one-third that of the abdominal operations. The results have been, on the whole, quite satisfactory. I have patients after the Lockhart-Mummery operation who are alive three years and five years, who, I am quite sure, did not have a complete removal of their growths. When one realizes that a patient whose tumour in the rectum has not been operated on will live only eighteen months and rarely two years, and that resection plus post-operative x-ray therapy will enhance the curability to a surprising degree it is not surprising that many surgeons are somewhat partial to the posterior resection for strictly selected cases.

Finally, it is well to emphasize that colostomy is not an operation for malignant growths of

the large bowel. It will and does prevent intestinal obstruction. It is necessary as a permanent mechanism when the rectum is resected, but our primary object should always be to remove the neoplasm as the basic part of any operation for malignant growths of the colon and rectum.

Emphasis should be placed, when the x-ray is used for diagnosis of malignant tumours of the large bowel, on the order of the x-ray examinations. If organic disease of the colon is suspected the barium colon enema should be utilized first. The mistake is made of doing the gastrointestinal series first, which in a more or less complete obstruction is apt to produce an acute intestinal obstruction. A further danger is to be anticipated later at operation if the intestinal tract above the obstruction is filled with barium. The barium tends to become scybalous, moulded into round billiard ball-like masses, and offers a tremendous handicap to the relief of the intestinal obstruction by caecostomy or colostomy. Barium proximal to the tumour is a very distinct danger when any anastomosis must be performed.

Transfusion of whole blood is one of the greatest aids in fortifying the patient before operation and in protecting him immediately afterward. It is our routine to give a transfusion immediately at the conclusion of an intestinal operation.

ANÆMIA OF THE NEW-BORN*

By J. CALDER

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ANÆMIA of the new-born is the simplest and the most descriptive of the terms used at present. During the past few years, since Ecklin¹ described a case of anæmia of a new-born infant in 1919, there has been considerable discussion of the subject. Authors have disagreed as to terminology, etiology, symptomatology, and treatment. That is, some have attempted to link together erythroblastosis, idiopathic anæmia of the new-born, icterus gravis, hydrops fetalis, etc., and others have tried to prove that each is a separate clinical entity. Space will not permit a lengthy discussion of these different viewpoints. We do feel, however, and we are sure that others agree with us, that there is a close

relationship between these different conditions, if they are not all one and the same thing. Dr. Isaac Abt² wrote as follows in 1935:

"Until the exact mechanism or etiology of these conditions has been discovered it will be difficult to prove or disprove whether they are inseparable. The simple addition or subtraction of clinical signs and symptoms can hardly be admitted as sufficient evidence for or against the identity of these conditions."

Etiology.—Here again one encounters considerable diversity of opinion. There may be, and probably is, a familial tendency. We have had three cases where two previous babies died with "anæmia"; in another family two successive infants had severe anæmia, and in a third family the second infant died with anæmia. One is inclined, therefore, to believe that there is a familial tendency. Abbott and Abbott³ state

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that ten cases of undoubted familial incidence have been reported.

What actually causes the anæmia remains obscure. It may result from increased destruction of red blood cells or from an underproduction, or both, but why, we do not know. Sepsis, syphilis, and the other "old reliables" have been featured as etiological agents, but these have all been ruled out. Pritchard and Smith⁴ reported a case in 1931, and concluded: "It is remarkable that in a case of such extreme anæmia, almost certainly due to hæmorrhage, there was not more definite evidence to point to the seat of the hæmorrhage." They thought that this condition was due to hæmorrhage, but autopsies have failed to substantiate this theory. Two other possibilities should be mentioned: (1) maternal anæmia; (2) failure of the mother to give to the infant the needed iron or other factors—because of an "impervious placenta". These theories have not been proved.

Symptoms.—Invariably the first symptom is anæmia. This is often times rapidly progressive, and usually becomes apparent during the first week of life. One of our patients was very pale and quite jaundiced six hours after birth. Jaundice is a variable symptom. In some of our cases there was an icterus of quite marked severity. There may or may not be œdema. In none of our cases has it been at all marked.

On physical examination one finds a very pale infant, perhaps jaundiced. If of long duration there is likely to be loss of weight and listlessness. The temperature may be elevated, though at times it is subnormal. On auscultation of the heart one may hear a hæmic murmur. The spleen is always enlarged. Sometimes the liver, too, appears to be increased in size, but because of its normal position in the new-born it is difficult to be certain.

THE BLOOD PICTURE

The red blood cells vary from one to three millions, the hæmoglobin from 20 to 60 per cent. These figures are more impressive when one recalls that during the first few days of life the average red blood count is 5,500,000, and the average hæmoglobin 100 per cent or greater. There may be a lymphocytosis, but this apparently is of no significance. The blood smear is quite characteristic, showing anisocytosis, poikilocytosis, marked achromia, and a large number of normoblasts, more numerous and persisting for a longer time than normal. The

bleeding time, clotting time, platelet count, fragility test, etc., are usually within normal limits. The colour-index in a fair percentage of cases is greater than one.

DIFFERENTIAL DIAGNOSIS

We will not attempt to differentiate the conditions which we mentioned earlier but will merely outline a few of the diseases which might be confused with anæmia of the new-born.

1. *Hæmorrhagia neonatorum.*—The outstanding diagnostic feature is hæmorrhage. If perchance the hæmorrhage should be internal only, as into the suprarenal, the differential diagnosis may prove rather difficult.

2. *Erythroblastic anæmia.*—As defined by Baty, Blackfan, and Diamond,⁵ this "is a disturbance of the hæmatopoietic system characterized by a constant racial and familial incidence, atypical fetal erythrocytes in the peripheral blood, enlargement of the spleen, distinctive changes in the bones, and, finally, histologic lesions in the bone marrow and spleen." The average age of onset is two years. It is thought to be limited to children of the Mediterranean peoples.

3. *Secondary anæmia* due to (a) sepsis—as a rule the clinical course is different, i.e., a high fluctuating temperature, and usually the focus of infection can be located; due to (b) syphilis—whereas in some cases of congenital syphilis the differential diagnosis may prove difficult, usually the presence of enlarged lymph nodes and spleen, rash, snuffles, a positive Wassermann test, etc., make easy the correct cause.

4. *Sickle-cell anæmia* is very uncommon under two years of age; also a blood smear will demonstrate the typical "sickle cells".

TREATMENT AND PROGNOSIS

Treatment of anæmia of the new-born is chiefly the administration of blood by transfusion. It may be necessary to give blood several times, this of course being determined by frequent blood counts. Liver extract may be given to these infants intramuscularly. It is claimed by some that this is beneficial. We have found that it is sometimes wise to change donors—different bloods seem to have different stimulating powers. When the onset is very early more transfusions may be necessary than when the onset is later. Regarding prognosis, it may be stated definitely that if these infants are not treated a percentage will die. By giving

early and repeated transfusions the mortality rate is greatly reduced. Our ten cases all recovered completely.

CASE REPORTS

During the past five years we have attended 10 new-born infants with what we have termed anæmia of the new-born. The time of onset has varied from six hours to nine days. Six were males and four were females. In four there was a definite familial history. In three families two previous infants had died with "jaundice

and anæmia". In another family we had two consecutive infants with severe anæmia necessitating repeated transfusions. In all of these infants there were jaundice, anæmia and enlarged spleens. When first seen by the pædiatrician the red blood count varied from 970,000 to 4,260,000, and the hæmoglobin from 25 to 96 per cent. The colour-index at first was always greater than one. The white blood counts varied from 12,000 to 25,000, all with the usual lymphocytosis. All blood smears showed numerous normoblasts.

TABLE I.

Case	Age	Weight	Date	Red blood cells	Hgb. percentage	Treatment	
						Date	Transfusion
1—B.K.....	6 days Born May 1, 1934	7¼ lb.	May 7	970,000	25	May 7	100 c.c.
			" 9	3,000,000	60		
			" 11	2,240,000	40	" 12	200 c.c.
			" 13	4,440,000	98		
2—B.R.....	2 days Born April 30, 1935	8¾ lb.	May 2	3,230,000	80	May 2	105 c.c.
			" 3	4,550,000	90		
			" 9	2,650,000	68	" 11	110 c.c.
			" 18	5,100,000	95		
3—B.A.W..	9 days Born May 2, 1934	7¾ lb.	May 11	1,060,000	30	May 12	100 c.c.
			" 15	2,800,100	50	" 15	110 c.c.
4—B.B.W..	4 days Born January 9, 1936	8 lb. 1 oz.	Jan. 13	1,850,000	36	Jan. 13	100 c.c.
			" 15	2,250,000	52		
			" 30	4,000,000	85		
5—B.C.....	6 hours Born January 5, 1935	7 lb. 7 oz.	Jan. 5	4,260,000	96	Jan. 5	100 c.c. (M)
			" 13	2,820,000	63	" 9	120 c.c. (F)
			" 25	4,670,000	88	" 13	120 c.c. (F)
6—B.T.....	24 hours Born April 13, 1936	9 lb. 3 oz.	Apr. 14	3,060,000	72		
			" 16	2,120,000	61	Jan. 16	100 c.c. (M)
			" 18	2,850,000	60	" 18	100 c.c. (F)
			" 20	2,250,000	60		
			" 21	1,660,000	35	" 21	120 c.c. (F)
			" 24	1,860,000	36	" 24	100 c.c. (M)
			" 25	3,500,000	57		
			" 30	2,260,000	49	" 30	100 c.c. (M)
			May 4	5,000,000	78		
7—J.....	Born March 9, 1938	6 lb. 1 oz.	Mar. 12	4,060,000	86		
			" 15	3,750,000	75	Mar. 15	100 c.c.
			" 18	5,850,000	86		
8—P.....	Born April 13, 1938	5½ lb.	Apr. 14	2,710,000	78	Apr. 14	80 c.c.
			" 15	2,602,000	100		
			" 21	2,640,000	49	" 22	80 c.c.
			" 25	4,230,000	66		
			" 30	4,210,000	66		
9—I.K.....	Born Nov. 17, 1938	7⅞ lb.	Nov. 27	1,040,000	25	Nov. 28	100 c.c.
			" 29	3,730,000	72		
			Dec. 2	2,570,000	46	Dec. 3	90 c.c.
			" 17	1,840,000	45	" 17	80 c.c.
			Jan. 9	3,000,000	60		
10—B.O....	Born Dec. 8, 1938	6½ lb.	Dec. 11	4,010,000	90		
			" 14	3,500,000	84		
			" 22	2,570,000	59	Dec. 22	60 c.c.
			" 24	3,290,000	65		
			" 31	2,710,000	60		
			Jan. 4	2,180,000	50	Jan. 5	80 c.c.
			" 7	3,200,000	65		

Strangely, all these infants were born during the winter and spring months, that is, between November 17th and May 2nd. This may not be of any particular significance because of the small series, but it will be of interest to follow the seasonal incidence in future cases. The mothers of all patients appeared to be in good health. None were anæmic. Their ages varied from twenty-one to twenty-eight years.

We have found it necessary to transfuse these infants from two to four times. Eight were given liver extract, one-half c.c. daily. The value of this is very doubtful. All of these infants

recovered. In some transfusions may not have been necessary, but with a red blood count below 2,000,000, or a family history of previous deaths during infancy from "anæmia", we believe that that treatment is indicated.

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LIPOMA OF THE DIAPHRAGM*

(WITH REPORT OF A CASE)

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PRIMARY tumours of the diaphragm are rare.

The literature contains reference to but 10 acceptable cases; of these 6 were benign and 4 malignant. The histological nature of the tumour was established by either operation or necropsy in eight instances. We wish to review the literature upon the subject and to report a primary lipoma.

The first reference to a primary tumour of the diaphragm is to be found in the 1886-87 *Transactions of the Pathological Society of London* under "Subpleural lipoma of the diaphragm" by Francis W. Clark.¹ The lipoma was discovered at the necropsy of a female aged 65 who died from the consequences of an intracapsular fracture of the femur. In this instance "the base of the rounded tumour, the size of a plover's egg, projected into the right pleural cavity." There were no adhesions of the lung to the parietes or to the lipoma, the base of which spread out between the muscle fibres of the diaphragm.

In 1912 Bonamy² reported the successful excision of multiple myofibromata of the right diaphragm. The clinical history in this instance referred to a painless palpable swelling below the 8th, 9th and 10th costal cartilages. The swelling had increased in size from the time that it was first observed by the patient, a thirty-four year old female. Interestingly enough, the

mass was regarded as a hydatid cyst of the liver. At operation, however, Bonamy found a large bluish-white mass attached to the diaphragm. He removed this mass and four similar smaller masses which were situated close by. Together they weighed 1,200 grams. Histologically these tumours were found to be composed of connective tissue and striated muscle fibres.

Burvell-Holmes and Brody³ reported an encapsulated angiofibroma of the right diaphragm. Their patient, a male aged 50, was originally admitted to the hospital for far advanced bilateral pulmonary tuberculosis. An x-ray examination of his chest revealed not only the pulmonary lesion but also a well-defined mass with an upper convex border which appeared as a shadow or density over the mesial half of the right diaphragm. The base of this "density" measured 8 cm. in the straight-on view, in the lateral view, 11 x 4 cm. Necropsy revealed the cause for the sharply defined "density" observed in the x-ray films. It was an encapsulated angiofibroma of the right diaphragm. The tumour which "rested" in a depression in the liver measured 12 x 6 x 5 cm.

Söderlund⁴ reported the case of a female aged 50 who complained of pain in the left lower chest and in whom an x-ray examination suggested the presence of a mass in the region of the left diaphragm. A lipiodol injection followed by the artificial induction of a pneumothorax and pneumoperitoneum defined this mass

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attached to the diaphragm. Thoracoscopy confirmed the presence of a tumour which was removed at operation. Histologically it proved to be a lipoma. The x-ray appearance of this tumour in the "pneumothorax picture" in many respects resembled that of a fibrin body.

Spangenberg, Gattini and Sloer⁵ reported upon a clinically benign tumour of the right diaphragm in a male aged 73. His complaints were dyspnoea and unilateral "wheezing". He had tachycardia; fine râles were audible over the right chest. An x-ray examination of the chest revealed the presence of a dense shadow in the region of the right diaphragm. At first this density was attributed to a hydatid cyst of the liver. A lipiodol injection of the lung, artificial pneumothorax, and pneumoperitoneum revealed the presence of a tumour of the right diaphragm. It was suggested that this tumour might be a myoma or fibroma. So far as we have been able to ascertain no surgical treatment was undertaken in this instance. Gravano⁶ reported a similar case. He disproved his original diagnosis of echinococcus cyst of the right lung by means of a diagnostic pneumothorax. Gravano was of the opinion that he was dealing with a benign fibromyoma of the right diaphragm.

CASE REPORT

The primary lipoma of the diaphragm which we wish to report was a necropsy finding in a female aged 45 who had been admitted to the department of gynaecology. An exploratory laparotomy, carried out by Dr. George Streen on July 6, 1935, revealed the presence of an inoperable pelvic tumour and peritonitis.

Necropsy was performed by Dr. David Seecof on July 7th, who reported the following findings: a malignant papillary cystadenoma of the right ovary, with metastasis to the regional lymph nodes; perforation of the anterior wall of the rectum; peritonitis; and a lipoma of the left diaphragm. X-ray examination of the chest which had been taken in the usual way previously was reported upon by Dr. Charles Liebman as negative. This is not surprising, for the lipoma, which measured 4 x 3 x 1.5 cm., was found to be situated in that part of the diaphragm which is hidden by the heart. This rounded localized fluctuant smooth mass, histologically a pure lipoma, was covered by parietal pleura. This fact alone excluded the possibility that one was dealing with the normal outgrowth of fat which is not infrequently found situated anteriorly close to the pericardial pleura and the diaphragm; and which was referred to by Clark.

It is assumed that Clark's remarks are not concerned with the deposit of fat occasionally noted on the parietal pericardium on the left side and which may be roentgenologically visible. It should also be noted that fat can be found on the edges of the lung subpleurally in the regions of the diaphragm. Fatty degeneration of the diaphragm, too, is a not uncommon finding.

The tumour in our case meets all the requirements for the diagnosis of lipoma. The lobu-

lated, localized, encapsulated collection of fat in this instance was situated under the pleura covering the diaphragm. Whether or not a lipoma so situated should be referred to as a subpleural lipoma or lipoma of the diaphragm is of academic importance. Clinically, the all-important consideration is the fact that all diagnostic procedures by exclusion permit one to establish relationship of a tumour with the diaphragm, and not with the pleura which covers it.

We shall now consider the reported primary malignant tumours of the diaphragm. Sauerbruch⁷ reported a primary fibromyosarcoma of the left diaphragm in a female aged 43. The chief complaint in this instance was abdominal pain. A mass could be palpated in the left hypochondrium. The tumour was excised. To our knowledge the final result has thus far not been reported. Müller⁸ reported upon a myoblastic sarcoma of the right diaphragm, which occurred in a female aged 45. This tumour measured 10 x 7 x 4 cm. and it was first discovered at necropsy.

Kirschbaum⁹ reported two primary malignant tumours of the diaphragm, one a rhabdomyosarcoma, the other a leiomyosarcoma. These two cases were collected from a series of 6,254 consecutive necropsies performed at the Cook County Hospital, Chicago. In both cases reported by Kirschbaum there were metastases in the lungs and pleurae, and in the case of the leiomyosarcoma, in the liver as well. The case reported by Dalzell¹⁰ as a primary round-cell sarcoma of the diaphragm probably represents a metastatic tumour by direct extension from a primary carcinoma of the lung. This impression is supported not only by the reported histological nature of the tumour but also by the fact that the mass incorporated both the diaphragm and lung. It is worthy of note, too, that in the literature previous to 1914 one finds many undifferentiated carcinomas of the lung labelled as round-cell sarcomas.

Since some proved primary tumours of the diaphragm reported in the literature were previously regarded as hydatid cysts of the liver, the possibility that tumours of the diaphragm are more common than one has been lead to believe must be considered. Such tumours may present themselves as palpable abdominal masses. It is the x-ray examination of the chest, however, which should arouse one's suspicion as to the possibility of the condition. Bronchography, pneumothorax, pneumoperitoneum and a thora-

coscopy permit not only of accurate localization but also of the exclusion of other supra- and infra-diaphragmatic conditions. A fluoroscopic examination will exclude the possibility that one is dealing with a double contour of the diaphragm, which is nearly always observed on the right side.

SUMMARY

Reference has been made to 6 benign and to 4 malignant tumours of the diaphragm reported by others. An additional case of primary lipoma of the diaphragm, the third to be reported, is described. Procedures which make an accurate diagnosis of primary tumour of the diaphragm possible have been considered. It is suggested that primary tumours of the diaphragm are perhaps of more frequent occurrence than previously believed.

We wish to acknowledge our thanks to Dr. George Streen for permission to report this case.

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Since this paper was submitted for publication two additional cases have been reported. Peery and Smith reported a primary rhabdomyosarcoma of the diaphragm (*Am. J. Cancer*, 1939, 35: 416). Gale and Edwards reported the successful removal of a primary malignant tumour of the right hemidiaphragm in a patient who has remained free from recurrence for nine months (to be published in the *Journal of Thoracic Surgery*).

Case Reports

SUBDIAPHRAGMATIC ABSCESS ONE AND A HALF YEARS AFTER LACERATION OF THE LIVER

By S. E. RUTHERFORD, M.D.

Windsor, Ont.

A.E.C., male, aged 30, was injured on July 29, 1935. A roll of paper (1,650 lbs.) dropped a distance of 20 feet into the hold of a freight vessel and as it bounced off the bottom of the boat it knocked him against a steel wall. He was admitted to hospital in a state of extreme shock; the right fibula and the internal condyle of the right humerus were fractured; and a laceration of the right elbow required four sutures. He was very tender in the abdominal region, especially on the right side. The next day he was unable to void, was vomiting, and had severe pains in the abdomen. The red blood cells were 3,470,000; white blood cells 10,600; polymorphonuclears 80 per cent; small lymphocytes 20 per cent. Nothing was given by mouth for four days and intravenous saline and glucose was given. On July 31st the abdomen was distended, rigid and tender, and red blood cells were present in the urine.

The diagnosis at this time was laceration and contusion of some of the abdominal and pelvic viscera without complete perforation. On August 4th his temperature went up to 106°; pulse 140; he had chills and was irrational. On August 5th his temperature was 97° (a drop of 9° in 12 hours). The next day occult blood was present in the stools and for several days he was moaning with pain in the right lower abdomen. X-ray films at this time showed no fractures of ribs, scapulae or clavicles; both domes of the diaphragm were smooth and even and the costo-phrenic angles were clear. The dorsal vertebrae showed slight lipping between the 5th, 6th, 7th and 8th vertebrae but there was

no fracture of any of the vertebrae nor of the pelvic or hip bones. At this time he developed a severe arthritis in the cervical inter-vertebral joints and shoulder joints which cleared up in one week under infra red ray therapy. The right lower abdomen was swollen and discoloured. On August 13th hgb. was 80 per cent; red blood cells 4,010,000; white blood cells 10,850; polymorphonuclears 75 per cent; small lymphocytes 25 per cent; non-protein nitrogen 42, and creatinin 1.5. On August 31st red blood cells were present in the urine (1 to 3 per field) and leucocytes were present (7 to 10 per field). The pain gradually subsided to a great extent, and on September 12th he was discharged from the hospital by ambulance. He continued however to complain of pain in the region of the right upper quadrant and through the bowels before defaecation and into his right chest at the back as well as in the right shoulder for the following one and a half years. This pain was so severe at times that it was necessary to administer morphine. At other times the pain would be so slight that he attempted doing various types of light work but without much success.

On March 9, 1937, nineteen months after his injury, he was admitted to hospital on account of a swelling in the right side of the back, just above the iliac crest. The following day we opened this abscess where it pointed, just above the crest of the ilium, and a large amount of pus was evacuated. Following the draining of this the pain which had been present in the right upper abdomen and chest and right shoulder for the previous nineteen months disappeared entirely. The wound continued to discharge for the next nine months.

On April 12, 1937, he was re-admitted to the hospital and we operated on his right radius for a chronic osteomyelitis which was another outcome of his accident, and removed a sequestrum (the radius had been discharging for several months). On April 26, 1937, he was again discharged from the hospital.

In November, 1937, with the patient under the fluoroscope, we injected sodium iodide, 10 per cent solution, into the discharging sinus above the crest of the

ilium and took x-ray pictures. This examination revealed a subdiaphragmatic abscess the size of an orange between the diaphragm and the upper surface of the posterior part of the liver. On account of the location of this abscess it was necessary to perform some type of a transthoracic, transpleural, transphrenic operation in order to expose it.

On December 12, 1937, he was re-admitted to the hospital, and on the following day we accomplished the first stage of our procedure in reaching the abscess by resecting the 9th, 10th and 11th ribs on the right side and suturing the parietal pleura lining the thoracic wall to the diaphragmatic pleura with plain catgut, enclosing a circle the size of a silver dollar. Iodoform gauze was then packed in the wound to stimulate adhesions between these pleural membranes, and the skin was closed with silk worm gut. Six days later we completed the operation. Methylene blue, 1 per cent aqueous solution, was injected in the sinus in the lower part of the back to completely fill the subphrenic abscess cavity. The skin sutures were removed, the iodoform gauze packing removed and with a long needle on a syringe we explored through the diaphragm from above down until we were able to aspirate methylene blue and thus know that we had located the abscess cavity. We then incised down along the course of the needle until we reached the abscess cavity, and unroofed it by clipping away as much of its upper and lateral wall as possible. The skin flaps were split and turned down in the wound to form a funnel lined with skin down to as near the cavity as possible. The following day he was given a blood transfusion, and on January 9, 1938 he was discharged from the hospital.

On March 1, 1938, the abscess cavity and sinus were completely healed and they have remained so since that date. On October 11, 1938, we operated on his right radius again as it was still discharging. The wound was laid wide open down to the bone and packed with sterile vaseline gauze. A plaster of Paris cast was applied and left on for one month without removing. By November 26, 1938, we were fortunate enough to have the radius completely healed and it has remained so since, and now after three and a half years' disability he is able to return to work. This man's weight at the time of his injury was 165 lbs. It went down to 98 lbs. and is now up to 145 lbs.

The osteomyelitis is mentioned in this report because it had a direct bearing on the course of this case. The man, at the time of his injury no doubt suffered from a laceration in the upper posterior part of his liver in the region of the bare area between the anterior and posterior layers of the coronary ligament, and a hæmatoma was formed at this site. The hæmatoma later became encysted in the same manner that a subdural cyst develops from a subdural hæmatoma following a serious injury to the skull. Later on this cyst became infected by means of a blood stream infection, the osteomyelitis in his right radius acting as the source of infection. Some might contend that this was strictly speaking a liver abscess rather than a subdiaphragmatic abscess, but it was in direct proximity to the inferior surface of the diaphragm and when it left the confines of the liver and began tracking down along the subfascial layers of the diaphragm and quadratus lumborum it became a true subdiaphragmatic abscess.

THREE CASES OF ACTINOMYCOSIS TREATED WITH SULPHANILAMIDE

By M. R. MACCHARLES AND J. W. KIPPEN

Winnipeg

CASE 1

Mr. M.A. This patient, aged 39, was admitted January 5, 1939, complaining of a swelling of the left side of the neck. It had begun below the angle of the left mandible three months previously. During this time it had spread downwards and medially and was situated at the level of the lower border of the larynx.

His teeth were found to be dirty, but not carious. The mass in the left side of the neck was 5 cm. in diameter. It was hard but not tender. It displaced the larynx to the right and definitely involved the sterno-mastoid muscle (actually the patient had been sent with a diagnosis of a carcinoma of the thyroid). The skin overlying the mass was normal and freely movable. A few small lymphatic glands were palpable in both supra-clavicular fossæ.

The Wassermann test was negative. Blood count: red blood cells 5,280,000; white blood cells 9,000, normal differential; hgb. 105 per cent. Urinalysis, negative.

Clinical course.—January 7th, 0.1 c.c. of 1/1,000 tuberculin was injected into the skin of the flexor surface of the left forearm. In 36 hours a violent local reaction had occurred accompanied by a rise in temperature to 101°, and a shrinkage and softening of the mass in the neck. On January 10th, this was incised and a small amount of pus escaped. Filaments of the ray fungus were demonstrated in the pus. Biopsy of the abscess wall showed non-specific subacute inflammation.

On January 12th, sulphanilamide treatment was started, 80 gr. daily for 3 days, then 60 gr. By January 17th the lesion had practically disappeared. Another tuberculin test was done on the opposite forearm and again a violent local reaction occurred.

On January 18th an x-ray of the chest revealed two discrete calcified areas in the left chest which were considered healed primary tuberculosis.

January 20th, patient was discharged apparently cured. He was advised to continue on sulphanilamide 45 gr. a day for another two weeks.

CASE 2

Miss I.P. This little girl, aged 9 years, was admitted January 24, 1939. She complained of a swelling in the right cheek which had been present for two months and was accompanied by slight pain on movement of her jaw. She had been referred to the hospital with a diagnosis of sarcoma of the jaw.

Examination revealed a large swelling over the front of the right antrum, obliterating the right naso-labial fold and raising the lower eyelid so as almost to close the eye. The swelling was of indiarubber consistency and slightly tender, with well defined borders. There was no sign of any lesion in the mouth and the lymph glands in the neck were normal.

The Wassermann test was negative. White blood cells 14,200; sedimentation rate 26 mm. in 1 hour; sedimentation index 56; urinalysis negative.

An x-ray of the skull was negative. On January 27th, a tuberculin test gave a negative reaction.

Clinical course.—On February 4th, no change having occurred, the swelling was opened by an incision in the buccal mucosa beside the alveolar border of the upper jaw. It turned out to be an abscess with a very thick wall. About 2 dr. of pus escaped into the mouth. A drainage tube was inserted into the cavity. There was a moderate reaction in the tissues of the cheek following drainage, and on February 9th softening occurred in the upper margin of the swelling, in the region of the lower eyelid. This softened area was drained and some fairly thick pus was evacuated. Examination of this pus revealed many Gram-positive cocci, fusiform

bacilli, and some long filamentous rods. On February 15th, typical sulphur granules were observed in the discharge. On microscopic examination the ray fungus was identified.

On February 19th, sulphanilamide, gr. 10 t.i.d., was given, and on February 23rd, the dose was increased to gr. 15 t.i.d. The blood sulphanilamide this day was 5.9 mg.

On February 25th there was a marked reduction in the size of the mass and the redness had disappeared, but there was a small area of softening just below the previous incision in the eyelid. This second area was incised on February 27th, and pus containing more sulphur granules was found. At this time the dose of sulphanilamide was reduced to gr. 10 t.i.d. and was continued at this level for two weeks after. The lesion rapidly disappeared and on March 20th, the patient was discharged from the hospital with the incision completely healed, and the lesion had entirely disappeared.

CASE 3

Mr. D.S., aged 54 years. The patient was admitted on December 5, 1938, under Dr. E. J. Washington, complaining of pain in the right cheek and throat, stiffness of the jaw, and general malaise for three weeks. Three days before admission his teeth had been extracted and this aggravated the condition.

Examination revealed a grossly infected mouth and evidence of an early quinsy on the right side. There were marked trismus and pain and tenderness in the right temporo-mandibular joint; temperature 99.4°.

Clinical course.—The patient was treated conservatively for two weeks, but the inflammation extended into the neck, and on December 19th it was found necessary to open an abscess at the right mandible. Microscopical examination of the pus and culture at this time showed only staphylococci. A sinus continued to discharge, although the swelling had subsided considerably. Repeated examination of the pus revealed only mixed organisms. No actinomyces filaments were found. The patient was discharged December 27th as improved.

The sinus was still discharging and there was considerable induration of the surrounding skin.

The man was readmitted January 5, 1939, and the area previously incised was swollen, tender and fluctuant. His temperature was 99°. The abscess was reopened and considerable pus found. Drainage was unsatisfactory, and on January 12th, under general anaesthesia the abscess was opened widely. Microscopical examination of the pus at this time revealed the ray fungus. The patient was immediately given sulphanilamide, gr. 20 q.i.d., for two days and then gr. 15 q.i.d. for three days. On January 17th the blood sulphanilamide was 3.7 mg. and the dosage was increased to gr. 25 q.i.d. for the following eight days. On January 23rd blood sulphanilamide was 7.9 mg.

The lesion melted away, and on February 5th he was discharged with all wounds completely healed and only slight induration in the scarred area at the angle of the jaw, and with no swelling present. There was no pain on opening the mouth and no limitation of movement.

Although it is impossible to draw definite conclusions from three cases the results obtained by the use of sulphanilamide, supplementing surgical drainage, have been so striking that the drug would appear to have definite value in the treatment of actinomycosis. These cases are reported in the hope that other cases of this rather uncommon disease might be treated in a similar manner and the results recorded.

The diagnosis in the first two cases was only made after a diligent and prolonged search for the organism by one of us (W.K.).

The authors would like to thank Dr. E. J. Washington for his permission to include his case (No. 3) in this report.

Therapeutics and Pharmacology

ACUTE CONGESTIVE HEART FAILURE

BY G. F. STRONG

Vancouver

Acute congestive heart failure, acute decompensation, or broken compensation, is the commonest of the acute cardiac emergencies. The clinical picture presented by these patients is too familiar to require repetition. They are acutely miserable and require immediate relief. While the onset of congestive failure is almost always gradual, the doctor is often or usually not called until the plight of the patient is desperate. These patients have usually suffered from lack of rest and sleep, and probably the most important first step is to insure a good rest which can only be done with morphine, by hypodermic. It is surprising that doctors will still try to relieve these patients with bromides or barbiturates, or will give an opiate by mouth

when only morphine by injection is adequate at this stage. Digitalis is, of course, the sheet anchor of the treatment of acute heart failure. In spite of all that is written and said about it this drug is still misused. The remarkable response to adequate digitalization is one of the bright spots in the treatment of heart disease. Inadequate dosage may delay recovery, and indeed the patient may get worse on too little digitalis. Mathematical formulæ are not necessary in reaching a decision as to how to give digitalis. While we know approximately how much of the drug is necessary for complete digitalization, in actual practice it is only necessary to give enough to accomplish our main purpose, which is to slow the heart. In the ordinary case of acute congestive heart failure 3 grains every 4 hours, until the apex rate (note, not the pulse rate) comes down to 80 or thereabouts, will be a suitable means of achieving the desired result. Occasionally in

young people larger initial doses can be given, 5 or 6 grains as the first dose, with subsequent dosage adjusted to the patient's need. The important thing is to use enough digitalis to bring the pulse and heart rate down to normal, then adjust the dose to maintain this improvement. Ordinarily, the maintenance dose will be $1\frac{1}{2}$ to 3 grains per day, though it may be much more, even up to 6 grains per day. The patient can usually be taught to regulate this for himself. The preparation of choice is the powdered leaf, either in tablet or capsule.

We are fortunate in having excellent and inexpensive digitalis available, and it is not necessary to resort to fancy preparations. The tincture may occasionally be used, but when it is the dose should be measured in minims and not in drops. In spite of repeated warning during the past two decades the profession still orders tincture of digitalis by drops when minims are intended. This is the commonest cause of inadequate digitalis therapy. One minim of water is equivalent to one drop, but one minim of tincture of digitalis is equivalent to 3 or 4 drops. Therefore, when drops are given instead of minims the patient gets only one-third to one-quarter of the estimated dose. This cannot be accurately corrected by increasing the number of drops because the size of the drop (the number per minim) varies with the size of the dropper and the rate at which the tincture is dropped.

In rare instances a patient may be unable to take digitalis by mouth, and we then have to resort to rectal or parenteral injection. For rectal use the tincture is the preparation of choice, the required amount being given in 2 to 3 oz. of normal saline. In this connection it is important to remember that ten minims of tincture is equivalent to one grain of powdered leaf. The initial dose should be 30 minims or more as may be required. The rectal method of administration has the disadvantage of causing some discomfort, and the results are uncertain because of the irregular absorption. For these reasons in those patients who cannot take digitalis by mouth the intravenous use of a potent preparation may at times be desirable. There are a number of such preparations; one that is excellent is the digoxin of Burroughs Wellcome & Co., put up in ampoules containing 0.5 mg., which may be given in 3 or 4 c.c. of normal saline, and repeated in 4, 6, and 8 hours, depend-

ing on the condition of the patient. Digoxin should not be used intravenously if the drug has been recently given by mouth. The intravenous route should be reserved for those few patients too ill when first seen to be effectively digitalized by the oral method.

Little need be said regarding the diet in acute congestive heart failure, as during the initial hours the patient requires and can take very little nourishment of any kind. With the disappearance of the acute symptoms, light nourishing food in small amounts frequently should be given, with the 24-hour intake limited to 800 to 1,200 calories. Fluids should be carefully limited from the first. These patients invariably show dropsy of some degree, and it is obviously futile to treat the dropsy without limiting the fluid intake. The intake of fluids and the output of urine should be measured. This simple rule is frequently overlooked yet it can be carried out quite easily even at home, and it is surprising how helpful the information obtained may be. The intake of fluids, and this must include everything "that pours", water, milk, fruit juices, soup, and tea and coffee, if allowed, must be limited to 20 to 30 oz. in the 24 hours. Thirty ounces or about 5 cupfuls, is therefore a definite reduction as compared with the ordinary intake.

In regard to diuretics there has been a great advance in the past ten years. Before that time we had to rely on digitalis and members of the xanthine group. The latter had the disadvantage of causing considerable gastric distress, and in addition were only of irregular effectiveness. We now have the advantage of the mercurial diuretics which have added greatly to our ability to aid these patients. The first of these, novasurol, was discontinued because of toxic effects, to be replaced by the milder salyrgan. A recent improvement has brought us mercupurin and neptal, in which the mercurial diuretic is combined with a xanthine derivative. These remedies are given intramuscularly or intravenously, but never subcutaneously, as they cause a severe sloughing. The dose is 1 to 2 c.c. repeated every 2 to 4 days, depending on the extent of the dropsy and the response to treatment. The effectiveness of these remedies is enhanced by the simultaneous administration of an acid salt, such as ammonium chloride which is conveniently put up in $7\frac{1}{2}$ gr. enteric coated tablets, two of which should be given four times a day. Where injection treat-

ment is inadvisable or impractical suppositories of these preparations may be used and in some cases are remarkably effective. These remedies may be used repeatedly in intermittent courses

over long periods with no apparent renal damage. Some patients show best response to one, some to another, so it is wise to try all three in the course of a resistant case.

Clinical and Laboratory Notes

COLDS AND ORAL COLD VACCINE

BY WALTER W. READ

*Medical Director, Northern Electric
Company, Limited,
Montreal*

Last fall and winter the Medical Department of the Northern Electric Company carried out an experiment on the treatment of colds with oral cold vaccine tablets.

We selected 50 employees who had a record in our files of being subject to mild and severe colds every winter for the past five years. As a check we took 50 other members of the staff who agreed to take no cold preventive treatment. This latter group were chosen to correspond closely in age, type of work, and home conditions to the fifty who were taking the tablets. Both groups reported once a week to the Medical Department from October to April, inclusive. When taking the tablets a number showed some reaction, chiefly a mild nasal discharge and

slight stuffiness in the head. There were no unpleasant symptoms in any of the fifty.

Of the 50 who took the treatment, 15, or 30 per cent, had no colds at all; 17, or 34 per cent, had mild colds with no lost time from work; 18, or 36 per cent, had colds with lost time from work. They had 66½ days' lost time, or 3.694 days per person per cold. All 18 reported colds milder in type and shorter in duration than they had been accustomed to.

Of the 50 who took no precautions against colds, 10, or 20 per cent had no colds at all; 24, or 48 per cent, had colds with no lost time from work; 16, or 32 per cent, had colds with loss of time totalling 106 days, or an average of 6.75 days per person per cold.

Each group consisted of 25 women and 25 men.

The results, as recorded above, show a considerable improvement in the health record of those taking the tablets. Naturally the number of cases is too small to be conclusive, but the results indicate some value in the oral method of using cold vaccine.

Editorials

THE CANADIAN MEDICAL ASSOCIATION AND THE NATIONAL EMERGENCY

EVIDENCE is not lacking that earnest endeavours are being made to utilize to the best advantage the services of citizens in all walks of life who have something to contribute to the war efforts in which Canada is now engaged.

As has been frequently said, square pegs must be kept out of round holes. Special talent and skill must be employed where it will be most useful. The Canadian Medical Association, fully believing that it could be helpful at the present time, immediately upon the outbreak of war, volunteered its services to the Government in any capacity properly coming under its scope. During the past month preliminary negotiations have been carried on, leading to an arrangement whereby the Association has agreed to

make a survey of the medical profession of Canada, and, at the same time, set up national and district medical advisory committees which will be available to give advice and direction leading to the best utilization of the medical profession of Canada, having regard to military and civilian needs.

The medical profession itself will no doubt welcome this arrangement because it would appear to be a guarantee to the profession that their services will not be wasted or misemployed; while the Government, on the other hand, will have available to it information which should permit of proper selection of personnel where and when it is needed.

In the last war medical organization in Canada had not reached the stage in its development where such cooperation on a national scale could be offered. Happily, at this time, the Canadian Medical Association, with its nine provincial Divisions and more than one hundred Branches, may be said to cover the field in a manner which makes it capable of representing the profession at this time. The Association has no desire or intention to intrude into fields in which it does not belong. The offer of the Canadian Medical Association carries no strings other than a keen desire to be of service to Canada in this critical hour.

Every registered medical practitioner in

Canada has been invited to indicate, by answering a questionnaire, what service, if any, he or she will be prepared to offer at this time. It is hoped that there will be a very high percentage of answers, because only in this manner can the Association assemble the necessary information upon which to base its subsequent advice. Canadian medicine may be expected to do its duty as it has done in the past. The Canadian Medical Association is happy in being permitted to act as an instrument for the collaboration and coordination of the medical profession with the military and civil authorities.

T. C. ROUTLEY.

WAR GASES

THE *Nova Scotia Medical Bulletin** has performed a timely service in publishing some material of practical value regarding war gases. The subject has become one of all too absorbing interest, and information on it is worthy of dissemination.

So-called "war-gases" are quite familiar in chemical industry, so that there need be nothing mysterious or obscure about them. Both solids and liquids are included under the term, and whilst there is a somewhat more terrifying and immediately injurious effect from their inhalation, there are also serious burning consequences from direct contact with the liquid or solid forms.

Modern respirators completely protect the face and respiratory tract against any war gas, but the "blister gases", mustard and lewisite, will damage any other part of the body with which they come in contact. The "tear gases" and "nasal irritants" are used primarily as harassing agents, compelling the use of respirators but being dangerous only in very high concentrations. Such gases as CO₂, nitrous fumes, screening smokes containing phosphorus, and a number of the chlorinated hydrocarbon series, may be encountered under such conditions as explosions in confined spaces, burning cordite, and certain military operations, but they are not used as war offensive measures. Highly toxic gases such as hydrocyanic acid and

hydrogen sulphide were not used in the last war to any extent because no effective methods of liberating them were evolved.

The two most effective gases are mustard gas and lewisite. Their physical and chemical properties must be realized if we are to understand their insidious action. They are both extremely persistent, due to slow vaporization; failing removal or neutralization, the fluid will continue to give off dangerous vapour for days or even weeks. Mustard gas has a faint, mustard-like odour when pure, and a more offensive, garlic-like smell in the crude form. Lewisite has a faint smell of geraniums. Inability to detect the odours of these gases is not a safe guide to their degree of concentration; indeed, atmospheres with low concentrations are particularly dangerous, as the comparative absence of smell renders them specially insidious, since it tends to cause an unduly prolonged exposure. Also, the sense of smell tires quickly, and in a gas-impregnated atmosphere the odour may not be detected after a time. One of the most serious qualities of mustard gas is that there is no immediate irritation of the skin on contact with the liquid, or of the eyes or respiratory tract in moderate concentrations of the vapour, so that contamination may be unsuspected. It is possible also for innocuous gases to mask harmful concentrations of the mustard gas and allow it to exert its effects undetected. Lewisite, on the other hand, causes immedi-

* September, 1939.

ate severe irritation of the nose and eyes, and blisters the skin more rapidly.

Mustard gas has a fairly high freezing point (57.9° F.), which somewhat limits its effectiveness in cold weather. Lewisite has a lower freezing point. Mustard gas is not greatly affected by moisture or by contact with most ordinary materials, so that articles of a very varied nature may remain dangerous to handle for a long time after contamination. Lewisite, on the other hand, is rapidly destroyed by water. Bleaching powder will rapidly neutralize both of these

gases, and is largely used in treatment in the form of a jelly. The ready solubility of both gases in animal fats accounts for their rapid penetration of the skin.

We have done no more than touch on a few points regarding these war gases. The literature regarding them is already extensive, and we hope will soon be available through governmental agencies. How much we may anticipate having to put this knowledge into practice it is not for us to say, but it would seem wise to inform ourselves fully on the matter.

H.E.M.

THE ASSOCIATION AND THE PROBLEM OF MEDICAL ECONOMICS

THE subject of Medical Economics is a broad one, so broad, indeed, as to lead to a good deal of confused thinking. Its various branches are closely related and to a considerable extent so interwoven that it is difficult to delineate their boundaries. Much has been said and written about various phases of medical economics, but in spite of this, perhaps because of it, clear thinking on the part of the medical profession and the laity is not so widespread as we could wish. For example, many are not sure as to the difference between medical relief, health insurance, and state medicine, and, particularly, in the matter of health insurance what it can and what it cannot do.

The subject of health insurance is of prime importance, as it becomes more insistent day by day. It concerns medical men and lay people as individuals and as corporate bodies. Its problems demand solution. If the medical profession does not provide the solution other people will, perhaps not to our liking. The individual doctor may, possibly, be articulate, but his voice is likely to be ineffective, the more so if he is not well informed as to his premises. Here is where collective action becomes essential. The only body in this country that is fully equipped to deal with the situation is the Canadian Medical Association. This is so because it is nation-wide in scope, democratic and representative, and is in a position to speak with authority. Every member of the medical profession would do well to become a member. By so doing he would become cognizant of what is going on and

would have a medium through which to present his views; he would also be certain of cooperation and action.

For some five years now our Association has concerned itself actively with the question of Health Insurance. At the Calgary meeting in 1934 a monumental and most exhaustive report was presented by the Committee on Medical Economics and seventeen principles of conduct were laid down, later increased to eighteen. The Atlantic City meeting was also noteworthy in this connection. The principles referred to have been adopted by the Association, but it should be pointed out that they are general in character; at no time has the Association committed itself to any definite "plan" for inaugurating a scheme of health insurance. The reason for this is that, while it has not been idle in the matter of collecting facts, principally derived from the experience of other countries, the Association has not had sufficient information in regard to the situation in Canada. This may seem surprising, but need not be so when we consider the extent of our country, the irregular distribution of our population, and the great variation in local needs and conditions. Then, again, it was felt that all the information that had been and could be gathered should first be made known to the medical profession at large. Health insurance has been proved in other countries to be a practicable workable proposition. But is this so for Canada? To make our conclusions reliable it was deemed necessary to call upon

the services of a man skilled in such investigations.

One main question that it is desirable to settle is whether any form of *compulsory* health insurance is desirable for Canada. It is desirable also to inform the profession at large on the many angles of health insurance. These things we believe, can and should be done, and when we are in possession of the necessary facts and have disseminated them the Association will be in a position to make the next forward move.

To these ends, the General Council of our Association, at the Annual Meeting held at Montreal last June, appointed Mr. Hugh H. Wolfenden, Consulting Actuary and Statistician, of Toronto, as Adviser on Medical Economics, with the instruction to "undertake an intensive and comprehensive study of the broad field of medical economics".

Mr. Wolfenden comes to us with the highest qualifications. For about ten years he has been connected with The Canadian Life Insurance Officers' Association, charged with the duty of making a study of such matters as health insurance, unemployment insurance, and old-age pensions. His wide experience and great knowledge in these fields cannot fail to be of value to our Association. We are sure that our expectations will be realized. In pursuance of our desire for publicity Mr. Wolfenden is preparing a series of articles pertinent to health insurance which will appear monthly in the *Journal*. The first of these, entitled "The Scope and Meaning of Medical Economics", appears in this issue (see p. 498). Our readers are earnestly advised to follow them. They will repay perusal and digestion.

A.G.N.

Editorial Comments

The X-ray Examination of Military Recruits

There is now no need to extol the value of the x-ray in the physical examination of the lungs. Recent events, however, have tended to emphasize this once more. We refer to the routine chest examination of recruits for military service. The time-honoured method with which we are all familiar is that of percussion and auscultation. To those who spend any time in tuberculosis institutions, or indeed any hospital, it is only too painfully evident how much one is apt to miss in the chest when guided by these means alone. When in addition to this the conditions of examination are such as obtain in recruiting offices, one feels convinced that as a method of detecting early or even moderately advanced pulmonary disease it is far from efficient.

This is in no sense a reflection on the efficiency of the examiners. It is a criticism on the system which depends on inadequate methods. We would draw attention to a paper in the present issue of the *Journal* by Dr. F. S. Burke, in which he deals with this point. His conclusion is that examination of the chest for military service should be carried out by the x-ray. In addition to this we may recall the resolution passed at the last meeting of the Canadian Tuberculosis Association, to the effect that they recommended the routine examination of every soldier by x-ray.

The physical examination of the chest should at least be supplemented by routine x-ray. Indeed it is a question whether a great deal of ineffectual labour might not be avoided by using

the x-ray alone. What would be gained? An enormous sum of money would be saved the country by preventing the enlistment of those whose unfitness is not less definite because it cannot be detected by ordinary examination. The x-ray should become an "ordinary" method. What would it cost? Certainly not more, almost certainly much less, than the eventual cost of those who are unfit. Could it be done without setting up elaborate and expensive x-ray centres? We see no reason why a plan should not be worked out whereby the already existing x-ray establishments in large centres could be made use of. We realize that it will call for planning, but it is all in the direction of utilizing to the best advantage all that we have learnt with regard to the medical aspect of war. H.E.M.

Harvey Cushing

A great man, "perhaps the foremost physician produced by the United States", has been lost to the profession with the death of Dr. Cushing, which occurred at New Haven on October 7th, from coronary thrombosis, in his 71st year.

Harvey Williams Cushing was born in 1869 into the fourth of five generations of uncommonly good doctors, at Cleveland, where his grandfather more than a century ago is said to have been chased home by wolves after his first confinement case in what is now the centre of the city. Educated at Yale (B.A., 1891) and at Harvard (M.D., 1895), he received his surgical training from Halsted at Johns Hopkins where he worked for 16 years as house officer and associate. Though he never actually served

under Osler or Welch, he became the devoted friend and disciple of both. He also studied abroad under Kocher and Kronecker at Berne, and with Sir Charles Sherrington. In 1912 he was called to Boston as Professor of Surgery at Harvard and Surgeon-in-Chief of the new Peter Bent Brigham Hospital. In the (late!) war he served with great distinction in France for over three years, first with the British and later as consultant to the American forces. When Harvard superannuated him, Yale wisely seized the opportunity to create a professorship of neurology for him in 1932, and two years ago he became "Emeritus" with the title—and with him it was no mere title—Director of Studies in the History of Medicine.

Physician, surgeon, humanist, and with much more than the temperament of an artist, Cushing prided himself, to quote one of his distinguished pupils, "upon being first of all a physician, a 'good doctor'." For him surgery was merely a form of therapy, and the primary responsibility of every man who entered the surgical field was to make himself at the outset thoroughly competent in the science and art of general medicine." Indeed, his contributions to clinical medicine were important, for example, his introduction of blood-pressure determinations into America in 1901, his early fostering of the study of the basal metabolic rate, and his life-long researches in endocrinology. His great monograph on the pituitary gland, 1912, is a classic, and in 1932 he described a new clinical entity, "pituitary basophilism", which has been called Cushing's disease. Early in his career he mastered the useful art of note-taking; his case-histories are models of completeness and are illuminated, like his diaries, with skilful drawings.

But it is, of course, as a surgeon, as the founder of the great new school of neurological surgeons, that Cushing is best known. In this respect he began the fulfilment of Osler's expectation that Minerva Medica would be induced to cross the Atlantic. For the first time European students, in order to master one branch of the healing art, were compelled to come to an American clinic. His pupils are to be found in all parts of the world, and if the brain is now

almost as safely accessible as the abdominal cavity, this is due entirely to Cushing's work, the methods he has developed, and his constant improvements in technique culminating in the introduction of the electrosurgical knife in 1927. It was not plain sailing, and only those who watched his beginnings, nearly forty years ago, can appreciate the faith and courage with which he carried on despite the many disappointments and failures. This same courage enabled him to overcome, almost to ignore, the real physical disability and suffering which had persisted since an attack of peripheral neuritis in France in 1918.

In addition to his contributions to our knowledge of the brain, he has immensely benefited general surgery by spreading the gospel of Halsted: "Slow and painstaking dissection, gentle handling of tissues, and the universal use of silk for closing wounds."

Osler was his foster-father in the humanities, and richly Cushing repaid him in that great *Life*, 1925, "the happiest fusion of the objective and subjective that biographical art has ever turned out in our rich literature" (Klebs). His war diary, "From a surgeon's journal", 1936, is a masterly document, and the essays collected in his "Consecratio medici", 1928, are worthy to stand beside "Æquanimitas". He was not born to the pen, but made himself master of it by sheer hard work. The fine annotated bibliography of his writings, which was presented to him last April by his pupils on his 70th birthday, credits him with 13 books and 330 papers. It was from Osler, too, that he caught his bibliomania. Medical art, history and old books were his hobby. I have a happy memory of having burst in on an orgy of adulation, when Osler and Cushing, pooling their early resources, had just finished covering the dining-table with the great folios and other first-fruits of the genius of Vesalius. Cushing's last task was a much needed bibliography of this, his favourite author; fortunately, it is said to have been sufficiently advanced to be completed and published. His great collection of the classics of medicine and science, in many respects richer than Osler's, has been bequeathed to the Yale School of Medicine.

W.W.F.

Medical Economics

I.

THE SCOPE AND MEANING OF MEDICAL ECONOMICS

BY HUGH H. WOLFENDEN, F.I.A., F.A.S., F.S.S.

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The great amount of discussion which has arisen within recent years concerning the wide subject generally called "Medical Economics" has naturally been of vital interest to the medical profession. The Canadian Medical Association has accordingly maintained a close watch upon the many proposals which have emerged from time to time in the course of these discussions, and has endeavoured to take its fair share and its proper place in considering the extent to which any of the suggestions may be expected to improve the present organization of medical practice. The series of articles of which this is the first has consequently been projected with the thought that the position of the medical profession, under present circumstances, may be clarified by a further examination of its most recent economic problems.

In order to find a starting point for a review of the existing situation it may be recalled that in 1934, at the Annual Meeting held in Calgary, the Committee on Economics presented an extensive report of 39 pages, dealing with many of the features which were considered to be important at that time. A list of seventeen principles then enunciated has, after slight modification and enlargement, since been affirmed in 1937 and 1938, and has been published in the form of "eighteen principles", embodying the criteria by which it is felt the medical profession itself can scrutinize and assess, from its particular viewpoint, the efficacy of any "insurance" plan which may be advanced. The importance of basing any "insurance" scheme upon a sound "actuarial" approach has also been emphasized. The Report of the Committee on Economics to the Annual Meeting at Montreal in June, 1939, moreover, recommended that the Canadian Medical Association "undertake an intensive and comprehensive study of the broad field of medical economics", that it "proceed at once to an active campaign of education of the medical profession in the fundamentals of medical economics", and that no attempts should be made to draft a "plan" of health insurance, or to modify the "eighteen principles", until the recommended studies and education of the profession have been undertaken.

THE DEFINITION OF "MEDICAL ECONOMICS"

The first procedure necessary in any such clarification of the problems involved must ob-

viously be a delineation of the field of "medical economics" which is to be thus surveyed. The Committee on several occasions has used a definition which may be repeated here. In its view "medical economics" is the "science" which "investigates the conditions and laws affecting the production, distribution, consumption, and cost of the various types and kinds of medical services that promote and preserve the health of the people". Even a brief consideration of this phraseology will reveal the wide range of questions to be covered, and the inevitably controversial nature of some of the aspects which must be explored. In these days of changing customs and procedures there is in every "economic" problem perhaps too much of unavoidable opportunism and expediency to warrant fully the appellation "science" to so complex and indefinite a domain. These articles therefore will not claim to present a "scientific" approach in the abstract and exclusively idealistic sense. They will, however, attempt to extract the essential underlying principles and practical devices from the mass of current controversy, with due recognition of the ethical foundations of the medical profession, and of those outside interests whose sympathetic co-operation must always be maintained.

In a survey of this kind by an actuary it may be well for the author to state, at the commencement, that his own father was a doctor, and that the devotion and attainments of the medical profession were thus for years a matter of daily observation. It will be taken as axiomatic, then, that the ethical concepts which form the background of medical practice must not ever be sacrificed to economic pressure from any source. The often highly confidential nature of the relationship between patient and physician certainly must be maintained. Economic difficulties, however pressing they may be, must not require that the diagnosis and treatment of disease shall be approached as a mass "efficiency" problem, without regard for the essentially individualistic elements involved. Personal characteristics must not be submerged and made unrecognizable beneath the inflexibilities of too much "planning". "Medical economics", accordingly, will be treated in these articles as the "study"—rather than the "science"—of the "production, distribution, consumption, and cost of the various types and kinds of medical services that promote and preserve the health of the people", with due regard for the ethical concepts of the medical profession, the highly confidential nature of the profession's services, and the necessity for maintaining always flexible procedures which can take into account the spiritual elements and the personal characteristics of the individuals concerned.

THE "ECONOMIC TASK" OF THE MEDICAL PROFESSION

Since the medical profession is obviously the body most clearly charged with the responsibility of considering these matters, it may be well next to define the "economic task" with which the profession is thus faced. That task has been described as the provision of "adequate medical care for all the people, at a price which is fair to all the people, including those who render the service". The words "medical care", however, might evidently be enlarged—for it has been emphasized on numerous occasions that the real task is not only the provision of "medical care" for those who fall ill, but that it is also the prevention of illness wherever preventive measures may be possible. The definition may therefore be expanded to read that the task in which the medical profession has its primary responsibility is "the development and provision of the best possible health services—both preventive and curative—for all the people, at a price which is fair to all the people, including those who render the services".

The importance of this dual aspect and its economic implications will be considered in subsequent articles. It would seem best to close this introductory discussion here, since the "Scope and Meaning of Medical Economics", and the "Economic Task of the Medical Profession", have now been given a general definition from

which the more detailed problems may be approached.

HEALTH SOCIETIES IN ALBERTA

In some places in Alberta "Health Societies" have been organized which canvass for members at a certain rate per year for medical and surgical services to the man and his dependents. These societies fix the fee for membership, as they fix the fee the contract doctor will get for each family. In addition they decide the number of families for which one man may be responsible. In order to get the number of families agreed upon, executive members of the Health Society divide the territory supposed to be tributary to the town in question into subdistricts, and appoint a certain member to be responsible for the quota in his area. In getting the quota the member responsible lauds the doctor who has agreed to the contract as against any other physician in the area. Thus, in actual fact, a special doctor has unpaid canvassers for him as against all others. The Council of the College of Physicians and Surgeons of Alberta at a recent meeting went on record that such a contract was undesirable and unethical and that any man entering into an arrangement to provide such medical services where a third party is concerned, and where all the practitioners affected are not given the opportunity to participate equally, shall be judged to be indulging in unethical practice.

G. E. LEARMONTH

Special Article

THE RELATION OF HEREDITY TO LIFE INSURANCE*

BY MADGE THURLOW MACKLIN, A.B.,
M.D., LL.D.

London, Ont.

At the risk of appearing too pedagogical I shall outline briefly the course of my argument, for I feel that one traverses a path better for knowing what lies at the end. In the words of Longfellow, I

"Shall take you by the hand,
And lead you to rest so gently that you go,
Scarce knowing if you wish to go or stay."

I sincerely hope, however, that the next line will not be too obviously fulfilled, for the poet goes on to say that you go,

"Being too full of sleep to understand".

After having travelled through the argument, to paraphrase Browning slightly,

* An Address given to the Canadian Life Insurance Officers' Association, at the Annual Meeting held in London, Ont.

"We shall arrive. What time, what circuit first,
Ask not. But unless God send his hail
Or blinding fireballs, sleet or stifling snow,
In some time, his good time—we shall arrive".

The path we take is this. First, to see why inheritance has become of increasing importance to life insurance. Second, to point out two ways in which this knowledge of heredity is of value: (a) through avoidance of accepting those with a poor family background; and (b) where this is impossible because of the late onset of the hereditary disease in the parents, through utilization of the information gained, to the end that the policyholder does not succumb to the disease which his family presents. We shall digress a moment to follow a bypath dealing with inheritance of cancer and mental diseases, and finally we shall arrive.

Heredity in disease has always been a matter of concern to you; it has become increasingly so in the last quarter of a century, when preventive medicine, adequate diets, sanitary engineering, have gone far to eliminate the tremendous death toll from infectious, deficiency and parasitic diseases which made the path from cradle to grave a mere faltering step or two. As deaths

from extrinsic causes decrease, those due to intrinsic or inherited causes must increase, since the chances of dying are unity. Therefore, as fewer of your claims are paid because of typhoid, cholera, or smallpox, more will be paid because of diabetes, heart disease and cancer. It becomes imperative then that you keep abreast of the newest knowledge of those diseases that are not imposed on man from without, but which arise through his hereditary tendencies. The factors which tend to lessen the importance of heredity are motor-car deaths, and war. In the past heredity has been chiefly of interest to you because it gave you a better estimate of the chances of the applicant living an average span of life. Did he come from a family noted for its longevity, for retention of clear mental capacity and earning ability until late in life, or the reverse?

HEREDITY AS AN AID IN PREVENTING THE ACCEPTANCE OF "POOR RISKS"

A still greater degree of application of this type of knowledge lies ahead as we learn more of the operation of the laws of heredity. We shall see that although many diseases formerly thought to be hereditary have now been removed from that class for every one so removed a dozen have been added; diseases formerly not recognized at all, or not known to be inherited, have now been placed in that class. Many of them, when taken alone, affect but a few persons; taken together they may be found in an appreciable percentage of the population. Some are very rare, others more common. Some are of importance only when insuring small children in a family; others assume significance not so much for causing death as for interfering with earning ability. Far from the significance of inheritance decreasing with the advance of knowledge it becomes increasingly more essential that we know something of its laws, and of what diseases may be expected to recur in a family, once they have been found to be present.

Diseases causing death before adult life.—Let us take the kind of diseases arising in children which are almost always fatal before maturity. There will be no history of the disease in the parents, but maybe another child in the family will have had the disease. A history of a non-infectious, constitutional disease in brothers and sisters of an applicant is far more important from your standpoint than would be a history of that same disease in one of the parents, for it shows that these particular parents have the capacity of producing the combination of factors which are the basis of the disease. What they have produced once in one child may be duplicated in another.

Retinal glioma is a tumour of the eye which if removed means blindness through loss of the eye, and if not removed causes death. Although fortunately rare, the disease is one which is apt to recur in other children in a family in which

it has once shown itself, and is liable apparently to affect about half the children. The disease is usually fatal before ten, therefore it would be most unwise to insure children in such a family until after that age has passed.

Hæmophilia is not so rare, and, despite the newest forms of treatment, is sufficiently uniformly fatal in early life to make its possessor a very poor risk. Not only is such a person a bad risk but his brothers and his sisters' sons are poor risks until they have reached late adolescence without having shown any signs of the disease.

Amaurotic idiocy, a type of mental defect fatal in childhood, when once found in a family should make other children in that family unacceptable until they are past five years of age.

Xeroderma pigmentosum, again rare, but fatal in practically 100 per cent of the cases, having once appeared in a family, should make the writer of policies careful of insuring other children in the family until they have reached the age of 18 or 20. I might mention numerous other examples of this type in which parents are never, or practically never, affected, and in which one has to determine the heredity from the fact that brothers and sisters are affected.

Let us now turn to a group of diseases which may cause death or may merely result in disability of varying degrees, but in either event prove disastrous not only to the patients themselves but also to the company which has insured them, especially if the policy be of the type in which premiums are discontinued following permanent disability.

Tuberculosis.—You might wonder at my including this disease which is so obviously dependant upon infection with the tubercle bacillus. On the other hand, the newer researches show that it is also dependent upon the hereditary susceptibility of the person who encounters the infection. Most of us by the time we have reached adult life have met and been infected by the tubercle bacillus. Not all of us develop the disease. This may be due to any one or a combination of the following factors: (a) the low virulence of the bacilli encountered; (b) the small amount of infection; (c) our ability to deal with it without becoming ill from it. The Indians and the negroes are notoriously susceptible to the disease. This is not altogether dependent upon their poorer living conditions, but in part is caused by their greater hereditary susceptibilities. A recent survey on tuberculosis by actuaries in Scotland (Lyon and Reid⁷) has shown that a family history of tuberculosis means a much higher death rate among the relatives, and that most of this increase is due to tuberculosis. It is true that a family history means greater opportunity for meeting the infection; it also means the inheritance of a susceptible soil. I will mention an illustration.

A family named T, in which for six generations there had been but one death attributable to tuberculosis on the father's side and none on the mother's for five generations, lived next door to a family named B in which there were three open cases of tuberculosis. The children of family T played as much in the house next door as they did in their own, helping the tuberculous mother take care of the other two tuberculous patients. All three died of the disease, but not one of the T children ever developed any symptoms. They had plenty of chance for infection but the bacilli fell on sterile soil in them.

This same report showed that if the policy was taken out by someone with a positive family history for tuberculosis before 35 the mortality was high among the insured, but among those past 35 the mortality was normal. In other words, those who were going to die of the disease had done so largely before they were 35; those who survived past that age were sufficiently resistant to live out a normal life-span.

There has been a marked decrease in the death rate from tuberculosis, and, as I showed in a study of Canadian data a few years ago,⁸ the decrease has paralleled to a close degree the amount of sanatorium space available for tuberculosis cases. I pointed out at the time, however, that this decrease is probably not due to an actual lowering of deaths among the infected but among the population outside, who are protected from infection by the quarantining of the tuberculous patients. Drolet,² of New York, has found a similar parallel between sanatorium accommodation and tuberculosis death rate for the countries of the world. In a second study,³ he shows that the tuberculosis death rate among the infected population is just the same today as it was 25 years ago. The newer methods of treatment such as pneumothorax, phrenicotomy, etc., have apparently not lowered the number of deaths due to tuberculosis among the affected, although death might be delayed for a few years. Thus a family history is of value to you in this disease, as you have long recognized, and the honours must be divided in an unknown proportion between heredity and infection.

Diseases affecting earning capacity.—We will turn for a moment to diseases purely hereditary, much less common, but perhaps as disastrous. The most spectacular occur in the realms of nervous disease. While in Philadelphia last December, I was asked by the Professor of Medicine of Jefferson Medical College to see with him two patients. They were brothers suffering from *syringomyelia* which destroyed the trophic nerves to the feet, resulting in large ulcers on the soles of their feet which never healed. Their grandfather, father, uncles, two cousins and they had the disease. It did not interfere with life, but with work, for they were either in the hospital for repeated amputations or were bedridden because of the ulcers. Being in the manual labour class they were handicapped in earning their living. The disease did not begin until the early 20's, so that all mem-

bers were poor risks until they had reached the age of 25 or so.

There is a whole group of nervous conditions, each in itself not common, which affect the patients at ages between 15 and 30, and which if found in one member of the family should make the others unacceptable until the age at which the condition is liable to develop is past.

I shall report briefly an actual case in which a knowledge of the inheritance of a disease would have saved the insurance company, although the man did not die of his inherited condition, but from an accident.

He wished to take out a life insurance policy. He proved to be physically fit. His mother had died several years before this policy was taken as an advanced case of polycystic kidneys. Her twin sister had also died of the same disease. Had the full force of this heredity been appreciated the man would have been examined not only by the routine methods, but would have been palpated for enlarged kidneys, and a pyelogram would have been included, whereupon the cystic kidneys which he had would have been found. Insurance would probably have been refused, for the average life of these patients is about 35. Two years after taking out his policy, he was killed and autopsy disclosed the fact that he had very much enlarged *polycystic kidneys*. Although his inheritance was not responsible for his death, a knowledge of it would have prevented the insurance company from paying out that claim.

Ten years ago I should have included pernicious anæmia, but because the disease is no longer necessarily fatal since the advent of the treatment by liver and ventriculin I shall refer to this in the next section. I have mentioned only a fragment of the hereditary diseases that are known today, and have attempted to show you that from the standpoint of writing policies a wide acquaintance with the field of inheritance is of economic value.

HEREDITY AS AN AID IN PREVENTING A POLICY FROM BECOMING A CLAIM

The greatest gain from this acquaintance I shall now refer to, one which I think holds more of economic value to you as well as more hope for mankind than does the first. I have been referring to heredity as of significance in preventing your acceptance of poor risks; I now shall dwell upon its ability to aid you in preventing a person who has a policy from becoming a claim through dying of his inherited disease. It happens that when the age of onset of the disease is late in life, the applicant for a life-insurance policy may be accepted before you have any way of knowing that the inherited disease is going to appear in his family. No amount of information as to the inheritability of the disease will help then, for the policy has been written. But if the disease is one which is curable or capable of being postponed by treatment, then you can use the knowledge of its heredity by having the client examined regularly for the onset of this disease. You will say that I am urging periodic examination on your policyholders and that these will ac-

comply the desired end with no particular knowledge of heredity. May I point out the fallacies inherent in that position?

In routine examinations for health you probably examine the heart, lungs and urine. Symptoms of a disease not revealed by this examination you will frequently miss. Thus the man just mentioned, whose polycystic kidneys could easily have been found had they been looked for, showed nothing in the urine, and so he was passed as physically fit. In pernicious anæmia, which we are beginning to appreciate has a definite hereditary basis, routine examination will not reveal the condition unless the anæmia is marked, by which time irreparable damage may have been done. We want to detect the disease when it is still early enough to be treated. Take an example.

A man of fifty was found to have pernicious anæmia. The newest therapy was begun, but the physician did not stop there. He examined the twin sons, aged 21, and the daughter. All had normal blood pictures. He went further, and examined the acid content of the stomach, and found that the daughter was normal, but the sons were lacking in hydrochloric acid, an inevitable accompaniment of pernicious anæmia. He began treating these twins as he was treating the father, and hopes to be able to prevent the disease from ever becoming outspoken in their cases.

Knowing what has occurred in the way of an inherited disease gives us a clue as to what may be expected in others of the family. Yearly examinations of the relatives of those who have an inherited disease may enable us to prevent the disease from developing, as well as giving us an idea of the length of time during which latent symptoms may exist before the disease becomes outspoken.

How is the life-insurance company to know what the relatives have died of, or have developed without dying, after the policy has been written? I have suggested that as a policyholder's near relatives become ill or die with any non-infectious or non-traumatic disease, these facts be recorded on his application blank at the payment of his next premium. If such knowledge is not used against the policyholder, and he is made to understand that the giving of this information is for his protection, not his detriment, he will give it willingly. I have met the objection that such work on the part of the company would involve too much expense in clerical assistance in keeping up the records to make it worth while. I wonder if that is true. A policyholder has two parents, probably not more than five or six brothers and sisters, and not more than that many children. As the children have a good chance of outliving the parent, the information concerning them might never have to be entered. Some of the brothers and sisters also might outlive the policyholder, and so no records might be entered for them. I have held a policy all my life, taken out for me as an infant by my mother, and in all that time only two entries would have had

to be made on it. Surely that is not a tremendously expensive job for keeping track of what I may be expected to die of.

Up to this point I have been mentioning diseases that are relatively rare and which may not have impressed you for that reason. But when we consider that diabetes, a great variety of heart and vascular diseases, and cancer in many instances have an inherited background, we come into a realm that is more significant numerically. Because these diseases are so largely an affair of late middle life, and since your applicants may have taken out their policies before these diseases developed in their parents, life-insurance records may not reveal the frequency with which they are inherited. The scheme of records which I have suggested would give you far better opportunity of evaluating the importance of inheritance, as well as giving you leads as to the direction which your periodic examinations might take in each case apart from the routine.

What a field awaits us in this respect! Do we know how long the inability to handle sugars has existed in the diabetic before he excretes sugar in the urine? Do we know how long he excretes it before he has actual symptoms? Even with the new treatment of diabetes the death rate from the disease has risen, not fallen, and will probably continue to rise until we devise methods for detecting the cases earlier.

Is it possible by chemical means or otherwise to detect early cases of cancer? Levin and Kuchur⁶ have found in Russia that the relatives of patients with gastric cancer have a far higher incidence of achlorhydria than the general population. Will this enable us to detect these potential cancer cases at the earliest possible moment? Will we be able to find out if there is some altered metabolism in the woman who develops breast or uterine cancer which can be detected by chemical or biological means? Hospitals cannot be expected to carry on this research; they are too busy caring for the actual sick. Moreover, the relatives may be in places not accessible to the research worker in the hospital. The life-insurance companies on the other hand often have available the relatives as well as the sick person, and could carry out a program of research on relatives living in centres large enough to have the investigative facilities available.

It may be objected that such research is not the business of the life-insurance companies, and should be carried out by medical institutions. It is difficult to secure continuity of research in such institutions, for the research worker is mostly doing such work for the love of it and not for the pay he gets. Removal of the worker by death or getting another job stops the work, and years of valuable effort may be lost. When the research is sponsored by a company, however, the problem goes on, no matter what happens to the worker, for the records and the

problems belong to the company and not to the man. Moreover problems of public and individual health are ultimately of economic importance to you. They may never be solved if left to other agencies, or the solution may be delayed indefinitely because to others they have not the same financial value as they have to you.

I have been referring to cancer as if it were inherited. I know the controversy that rages around that question, and had I the time I could present enough valid arguments to show that heredity plays a very large part in cancer production. Like a great many other diseases cancer is dependent upon a combination of inheritance and external forces. Some tumours will arise through the hereditary factor alone; some will occur in which the external factors play a leading rôle; others will depend upon varying combinations of heredity and external conditions. Because some of the supposedly best arguments against heredity in cancer have been based upon the analysis of life-insurance data by life-insurance men I want to go into this question a little more fully.

Hunter,⁵ of the New York Life, has taken two groups of policyholders, one dying of cancer, and the other of some cause other than cancer. He has completed the family histories of these groups, filling in all the details of cancer deaths from the time the policy was written until it became a claim. He has determined the percentage of cancer deaths in the ascendants of the two groups, and found it to be about the same for both. He has concluded, since a history of cancer was no more reason for suspecting cancer in the descendants than not, that there was no proof that cancer was inherited. I have pointed out that his conclusions are not valid because his data were not collected in such a way as to disclose any hereditary factor if present.

Cancer is a term covering a great many different forms of tumour, just as the term "infectious diseases" covers conditions as diverse as diphtheria and syphilis, small-pox and influenza. When one investigates the inheritance, not of cancer in general but of a particular organ, then one finds strong support for the idea that cancer of that organ is inherited. Female relatives of women with cancer of the breast have far more cancer than women in general, and the increase is accounted for largely by the fact that they show cancer of the breast (Wasink, cited by Cramer). Male relatives of such women show no higher incidence of cancer than the general population of men. Female relatives of women with cancer of the uterus show far more cancer of the uterus than do women in general. Thus cancer is not inherited but *the capacity to develop a particular type of tumour in a particular organ is inherited*. When we apply this concept to Hunter's data we see why he obtained the results he did. Approximately 90 per cent of life-insurance clients are male. Twenty to 30 per cent of all tumours of both

sexes are the uterine and breast cancers of the female. Many men in his non-cancerous group who had relatives with cancer had mothers and sisters with uterine and breast cancer. They could not show cancer of these organs, and so weighted the non-cancerous group with cancerous relatives unduly.

This reminds me of an actual occurrence. I was lecturing on inheritance in cancer. I had just enunciated that it was the cancer of a particular organ that was hereditary. A man got up and said, "My great-grandmother died of uterine cancer. My grandmother died of the same thing; my mother had it but was operated upon in time to save her life. If what you say is true, that is a very black outlook for me." I assured him that on that score he need have no fear; that he would never develop cancer of the uterus, even if he had inherited a factor for it; that it was like being all dressed-up and no place to go.

Anyone studying the inheritance of cancer must select one type and study that. If Hunter studies the inheritance of a cancer which can occur in both sexes, such as rectal or gastric, he will probably find the same relation exists as holds for mammary and uterine, namely, that the relatives have a higher incidence of rectal or of gastric cancer than has the general population. The New York Life Insurance Company, so I have been told, now includes the site of cancer in its records as well as the fact that there was cancer.

One point more with respect to inheritance of cancer. We have become so accustomed to seeing cancer in several members in a family that we have accepted it without thinking about it, just as the people who saw apples fall accepted it without finding the law behind it until Newton enunciated the law of gravitation. Far from expecting to find cancer in several members of a family on the basis of chance, as some statisticians have asserted, we would expect to find it rather seldom, for although cancer as such kills 1 in 9, cancer of the stomach or rectum or breast does not kill 1 in 9, but perhaps 1 in 50 or 1 in 100. If you compute how often you would find such an event occurring by chance in three or four persons in a family who had all lived to 40 or more, you would find that the odds were tremendously against it, unless some underlying law, such as the law of heredity were in operation. But its very frequency in three or four persons in a family has dulled our minds to the significance of that law. Just as you might accept with equanimity, although some envy, your opponent's dealing himself a perfect suit of spades, you would not tolerate his dealing himself a perfect hand of hearts an hour later, and a perfect hand of clubs after that. You would feel that this was happening too often to be explainable on chance. So the same type of tumour occurring in the same organ in several members of a family occurs far too often for it

to be mere chance regulating the appearance of the tumour.

But what value can inheritance of tumour be to the life-insurance company? I will give briefly three examples.

A man of 54 was examined for stomach cancer for no other reason than that his brother had just been operated upon for that condition. He had no symptoms which would lead him or the doctor to suspect cancer, but on examination he was found to have an early cancer in exactly the same situation in the stomach as his brother had had. Operation at a time months, perhaps years, earlier than it would have been performed had he waited for symptoms, has no doubt saved him many years of life, and incidentally will enable him to pay more premiums before the life-insurance company pays his claim.

Two sisters aged 34 and 32 were both operated upon for early rectal cancer for no other reason than that they desired an examination when their 35-year-old sister had an operation for rectal cancer.

Two women, identical twins, have this history. One had a cancer of the right breast. Three years later the other twin had a cancer of the right breast. The first twin then developed cancer of the left breast, and some time later the second twin developed cancer of the left breast. The first twin has now some eight years later, developed a primary cancer of the ovary. The second twin is not as yet involved.

What is the most sensible thing to do with the second twin? The physicians are still trying to settle that question; they may not remove the ovaries of the second twin, but they will certainly be more alert to any symptoms she may develop because of the history of the first twin.

I cannot forego mentioning briefly inheritance in mental diseases. Some of these are definitely infectious, such as general paresis, some are definitely hereditary, such as Huntingdon's chorea; some are believed to be environmental in origin by one group and hereditary by another. In view of the controversy raging about him the layman is undecided as to which view is more nearly correct, and is swayed by the more oratorical of the schools of thought. Although psychiatrists have some justification in criticizing the findings of some of the workers who have thought dementia præcox and manic-depressive psychoses are hereditary, claiming that they have been influenced more by wish-fulfillment than by fact, the same criticism can be applied to the psychiatrists who discard all or even most evidence of inheritance. They have yet to treat their theories with the same rigid scientific yardstick of controls that the chemist, the physicist, or the biologist must use in evaluating their theories. Not until they have done this and put their ideas on a scientific basis can their views on heredity in mental disease be accorded the respect which those of scientists command. Because on this side of the water many psychiatrists are inclined to belittle the rôle of heredity in any type of mental disease, I should like to quote from Dr. Goodall,⁴ President of the Section of Psychiatry in the Royal Society of Medicine in England. He says:

"There are bodies here which lay themselves out to educate the public in matters appertaining to general and mental health; these deal with general and mental hygiene, antenatal care, child guidance, home and school influence, and the like. The subject of the environment has been riddled with the machine-guns of eloquence. How often do these mentors of the public, medical or other, touch upon the fundamentals of genetics, upon inheritance, and its bearing upon health and disease in the individual and his offspring? They take the line of least resistance, the environment, a subject lending itself to diffuse, uncritical platform oratory. I suspect that our social guides know exceedingly little about, and exhibit no enthusiasm to learn about, the hereditary factor. I would refer them to such a work as that by Verschuer from which they will appreciate that more and more does the importance of the hereditary factor, from comparatively trivial to serious disease, thrust itself upon us. Even the members of our own profession seem to me to be in the main singularly uninterested and uninstructed in this matter. They cannot afford to be so much longer."

Certainly this question is of economic importance to life-insurance companies. Here again the records which contained the hereditary illnesses of the relatives of the applicant after the policy goes into force, although costing something in clerical labour, might well repay you in accurate knowledge for future use.

Finally, I should not be expressing completely my attitude on the relation of heredity to life insurance, did I not mention the part you play in what we might term sociological inheritance. It so happens that your business is founded upon basic sociological principles. The more who participate in its benefits, the better not only for them and for business, but also for the rest who have been insured. Unlike many forms of modern enterprise, whose effects are excellent when restricted to the few, but nullified or even detrimental when extended to all, life insurance if limited to a small group becomes prohibitive in price; it is capable of realization only when open to the great majority. Next, it encourages that which may soon become as extinct in our civilization as the dinosaur, namely a sense of independence, a determination to be self-supporting, and to put aside enough for one's old age so that charity, whether in the form of the alms house, old-age pensions, relief, etc., need not be one's portion in the declining years of life. The modern trend is all away from a "pay as you go" policy, toward a "Let George do it" program, "George" being a paternalistic government which saves us developing private thrift, by itself spending now, and postponing the day of reckoning to a future generation who had nothing to say about acquiring the debt.

I congratulate you upon being a business that combines business principles with a cultivation of thrift in the community; which stimulates people to rely on themselves rather than upon a philanthropy which would fall to the ground if we all applied for it, and requires a hard-working group of taxpayers to pay the bill that others may enjoy the benefits.

I promised you that we should arrive in good time. I have led you by a path, I trust not too devious, to the enunciation of the theme with which I started, that an intimate knowledge of inheritance is of benefit to life insurance. I have shown you that, as it has done in the past, such knowledge will continue to assist you in avoiding very poor risks, only in a wider field than perhaps you knew. I have mentioned an infectious disease, which despite all our efforts at eradication still remains the great killer in the young, namely tuberculosis, and have emphasized that it has its hereditary element as well as a strong infectious origin. Not only is a knowledge of heredity of value in avoiding those with poor chances of living a reasonable span of life, it will be of even greater value, the more we make use of it, and the more research we devote to it, in detecting early symptoms in those who may develop a disease to which a relative has already fallen victim. I have dwelt for a few moments on the importance of inheritance in cancer and in mental disease, two fields in which there is not universal agreement, but which, as research in them and in inheritance in general proceeds, will be found to be more and more in the inheritance class.

Finally, I have suggested that you become interested in heredity not only as applied to the physical and mental aspects of the race, but that you must become increasingly aware of the value of heredity in moral outlook. As a business, you necessarily are interested in all that pertains to physical health; you must become increasingly interested as a business in heredity which looks to the perpetuation of that element of the race which retains not only high physical endowment but also those intellectual qualities which permit of independence, and those spiritual assets which induce us to exercise it.

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ESSENTIAL HYPERTENSION.—In a study of 200 cases of essential hypertension an excessive narrowing of the arterioles, due either to histological changes or to increased vasoconstriction, was revealed as a constant abnormal factor. The clinical subdivision of the cases into four groups has considerably increased the accuracy of prognosis. The statistical finding of a distinct survival curve for each group adds to the value of the view that distinct types of essential hypertension can be differentiated clinically.—N. M. Keith, H. P. Wagener and N. W. Barker: *Am. J. M. Sc.*, 1939, 197: 332. Abs. in *Brit. M. J.*

Association Notes

The Annual Meeting of the Canadian Medical Association—Alberta Division

The fourth annual meeting was held in Edmonton on September 21st to the 23rd. Dr. C. R. Bunn, the President, presided at all the sessions. We welcomed to our midst the representatives of the Canadian Medical Association; also, Dr. H. B. Cushing, emeritus professor of pædiatrics, McGill University; Dr. Roscoe Graham, assistant professor of surgery, Toronto University; Dr. Frank H. Krusen, chief of the section of physical therapy, the Mayo Clinic; Dr. W. G. Cosbie, senior demonstrator of obstetrics and gynaecology, Toronto University; and Mr. Hugh Wolfenden, F.I.A., consulting actuary and statistician. We missed the genial presence of Dr. T. C. Routley, whose informative talks we have enjoyed at our annual meetings for many years. He was unable to be with us. Dr. Frank Patch, the President of the Canadian Medical Association, was also unable to attend. Each one of the visiting speakers from the East added materially to the value of the scientific program and their addresses were much appreciated.

Dr. H. B. Cushing discussed "Indications for and results from removal of tonsils and adenoids" and "Prevention and treatment of scarlet fever". Dr. Frank H. Krusen gave talks on "Physical therapy in traumatic surgery" and "Physical therapy in chronic rheumatism". Dr. Roscoe Graham's addresses were on "Cæcostomy—a simple and safe measure in disease of the colon" and "The surgeon's responsibility in cancer". Dr. W. G. Cosbie discussed "Cancer of the cervix" and "Maternal mortality".

Dr. W. H. McGuffin, of Calgary, opened a discussion on "Cancer control", which was participated in by Drs. J. S. McEachern and Roscoe Graham. Dr. M. R. Bow, Deputy Minister of Health for Alberta, gave an interesting paper on "Ticks and tick-borne diseases". Dr. D. S. Macnab's paper was on "Intussusception". Dr. A. C. McGugan gave a paper on "Hospital cancer cases", Dr. H. N. Jennings on "Drugs in heart diseases", and Dr. H. V. Morgan on "Fluid balance in surgical diseases".

At the banquet held at the Macdonald Hotel, Dr. C. R. Bunn, the retiring president, invested Dr. L. J. O'Brien, president for the coming year, with the insignia of office.

The social side of the meeting was well taken care of and golf was enjoyed by many of our members. Mrs. M. F. Newell was in charge of the arrangements for the entertainment of the visiting ladies, and these included a drive to St. Albert Shrine, luncheon at the Springer Hotel and at the Mayfair Golf and Country Club, private dinner parties, and a theatre party.

The following is the list of officers elected at the annual meeting for 1939-40: *President*, Dr. L. J. O'Brien, Grande Prairie; *Vice-president*, Dr. F. T. Campbell, Calgary; *Librarian*, Dr. H. C. Jamieson, Edmonton; *Honorary Secretary-Treasurer*, Dr. G. R. Johnson, Calgary. *Representatives to the Council of the Canadian Medical Association*, Drs. C. R. Bunn (*chairman*), G. R. Johnson, L. J. O'Brien, F. W. Gershaw, Allen Day and R. B. Francis. *Divisional Editorial Board of the Canadian Medical Association*, Drs. G. E. Learmonth (*chairman*), Heber Jamieson, Harold Orr, F. C. Galbraith, J. R. Patterson and G. M. Smaltz.

G. E. LEARMONTH

The Canadian Medical Association— British Columbia Division

The Annual Meeting of the British Columbia Medical Association was the outstanding event of the year. It was held from September 18th to 21st inclusive. The attendance was the largest, we believe, in the history of the Association. Some 342 members registered. A very gratifying feature of the attendance, and, in view of the present situation of affairs, a rather surprising one, was the large representation from out of town points in the Province, every division of the Association being well represented.

The scientific portion of the program was excellent; designed, as it was, to meet chiefly the needs of the man in general practice, it could hardly have been bettered. The speakers were as follows: Drs. R. Franklin Carter, New York City, Associate Professor of Clinical Surgery, Columbia University; W. G. Cosbie, Toronto, Senior Demonstrator in Obstetrics and Gynaecology, University of Toronto; H. B. Cushing, Montreal, Emeritus Professor of Paediatrics, McGill University; Alexander Gibson, Winnipeg, Associate Professor of Clinical Orthopaedic Surgery, University of Manitoba; Roscoe R. Graham, Toronto, Assistant Professor of Surgery, University of Toronto; E. P. Scarlett, Calgary, Internal Medicine. Each one of these men left an indelible impression on the meeting, by his excellent material and presentation thereof.

It is greatly to be regretted that Dr. Frank S. Patch, of Montreal, was unable to be present, on account of military duty. Drs. A. W. Hunter and Lee Smith, of Vancouver, however, gave admirable lectures on Urology, the subject Dr. Patch was to undertake, and they are to be sincerely congratulated on the excellence of their papers.

Films, demonstrations, round-table conferences on Obstetrics, Orthopaedics, Internal Medicine, and Public Health, were all of great value. All meetings were well attended.

From the economic side this Annual Meeting was very significant. The first evening was given up to the discussion of a plan of voluntary Health Insurance that had been worked out by

the Committee on Economics of the British Columbia Medical Council. This was very fully discussed. Mr. Hugh Wolfenden, F.S.A., of Toronto, the Consulting Actuary to the Council of the Canadian Medical Association, was present and joined in the discussion. This scheme is rapidly assuming concrete form and will probably be put forward at an early date. Further meetings on economic matters affecting organized medicine were held, with Mr. Wolfenden as the leader of discussion, and this gentleman made a very deep impression on the membership of the Association by his courtesy and obvious desire to be of service, as well as by his remarkable proficiency in this subject of economics. It is not too much to say that his visit alone, without any other program, would have made the meeting well worth while and a notable one.

Another very important meeting was that dealing with "The rôle of the doctor in war". A very full and free discussion was held, and the profession showed complete unanimity in its desire to be of the greatest possible service, both at home, with the greatest regard to the needs of the civilian population, and abroad. It was felt that it was of great importance that men should serve when and where they were needed, and in the capacity to which they were best fitted by training and personal aptitude, and that there should be cooperative rather than individual action in the matter.

Dr. F. M. Auld, of Nelson, was elected *President* for the coming year and the Annual Meeting in 1940 will be held at Nelson, B.C. The list of officers is as follows: *President*, Dr. F. M. Auld, Nelson; *First Vice-president*, Dr. E. Murray Blair, Vancouver; *Second Vice-president*, Dr. C. H. Hankinson, Prince Rupert; *Honorary Secretary-Treasurer*, Dr. A. H. Spohn, Vancouver.

J. H. MACDERMOT

The Manitoba Medical Association

Despite the state of war which prevented the attendance of some of the eastern doctors whose names had appeared on the program the Annual Meeting of the Manitoba Medical Association was held in the Royal Alexandra Hotel on September 11th, 12th and 13th. Dr. Roscoe R. Graham and Dr. W. G. Cosbie, of Toronto, Dr. H. B. Cushing, Montreal, Dr. C. H. Vrooman of Vancouver, and Mr. Hugh H. Wolfenden, Consulting Actuary of the Canadian Medical Association, were welcome visitors who contributed much to the success of the meeting.

The evening of September 11th was given to the economic aspects of medicine with Mr. Wolfenden, Dr. F. W. Jackson and Dr. E. S. Moorhead contributing. Dr. Jackson discussed the rural health survey now being carried on in Manitoba. Dr. Moorhead dealt with the economics of urban medical practice, and Mr. Wolfenden expressed himself as being in favour of nation-wide health insurance. An excellent

clinical meeting was held in the Medical College on the morning of September 12th.

At the business meeting the following officers were elected: *President*, Dr. W. E. Campbell, Winnipeg; *First Vice-president*, Dr. E. D. Hudson, Hamiota; *Second Vice-president*, Dr. H. D. Kitchen, Winnipeg; *Secretary*, Dr. C. W. MacCharles, Winnipeg; *Treasurer*, Dr. C. E. Corrigan, Winnipeg; Dr. Frank Purdie, Griswold, Rural Member at large to the Executive. Dr. A. M. Goodwin was elected Winnipeg representative to the Executive.

The Association pledged its full support to the Canadian government in its war campaign, agreed to cooperate with the Canadian Medical Association and to fall in with any planned campaign which the Federal body might adopt in its attempt to coordinate the efforts of the profession in the struggle.

The Committee on Maternal Mortality reported the lowest maternal mortality ever recorded in Manitoba, 2.7 maternal deaths per 1,000 live births. The Pregnancy Survey is to be continued in Manitoba for another year.

ROSS MITCHELL

Hospital Service Department Notes

A Provident Scheme for Patients of Limited Income in Greater London

A new plan to help the patient of modest income meet his medical and hospital charges has been announced by the King Edward's Hospital Fund of London. This is to be applicable to single subscribers with an income up to £400, to married couples with incomes up to £550 and up to £700 where there are dependants under 18 years of age. It is designed to supplement rather than supplant the present Hospital Savings Association plan and is essentially a plan for the voluntary hospitals of Greater London.

The Benefit provides for the whole cost of maintenance in a participating voluntary hospital for a period of four weeks. It also covers the cost of medical or specialist care for the same period with grants-in-aid in respect of additional specialist services. It will also provide modified grants-in-aid for maintenance and treatment in a nursing home.

Provision is made also for radiological diagnosis and for pathological and bacteriological investigations. Also discretionary payments up to £12 12s in any one year may be made towards the cost of treatment or service by a physician (apparently not the family physician), bacteriologist, or other specialist not included above.

All communications intended for the Department of Hospital Service of the Canadian Medical Association should be addressed to Dr. Harvey Agnew, 184 College Street, Toronto.

The consultants or specialists must be on an approved list. Payments will be made direct and on a scale to be approved by the British Medical Association. Payment will be only for the period in hospital and patients must have been recommended for such care by their regular attendant (except in case of emergency).

Each hospital, if unable to provide accommodation at the rate paid by the scheme, must permit the patient to go into a more expensive ward by paying the difference in price.

There will be a waiting period of six months and an age limit of 65 years on the first acceptance. It is anticipated that this plan will retain for the voluntary hospitals and their staffs many patients who otherwise would go elsewhere or continue to depend on charity.

The Cancer Campaign

The Cancer Campaign in New Zealand

As the result of the visit to New Zealand in 1929 of Mr. W. Sampson Handley, authorized by the Duke of York, now King George VI, a branch of the British Empire Cancer Campaign was established in New Zealand. This branch has the support of and could, if necessary, have financial assistance from the Government. However, in accordance with the policy of the society, donations were invited from the citizens of New Zealand for the purpose of engaging the interest of individuals in what is in large measure a personal rather than a Government problem. From first to last a sum approaching £100,000 has been raised in this way. It was considered advisable that the organization of a New Zealand branch of the British Empire Cancer Campaign should follow that of the British Medical Association. Accordingly, there are various divisions corresponding to the provinces of New Zealand, and these divisions are autonomous but co-ordinated in the central branch council. This branch joins with the various State and the Commonwealth cancer societies of Australia, which hold an annual joint conference. The last conference, in February of this year, was held in Wellington under the auspices of both the Commonwealth and the Dominion Governments.

One of the first activities of the New Zealand Branch was to establish, in connection with the medical school at Dunedin, a medical research laboratory. A New Zealander, Dr. A. M. Begg, who was working at the Stroud Laboratory in London, was appointed director of the New Zealand Cancer Research Laboratory, and he has the assistance of Mr. Hall as technician. Dr. Begg is at present engaged on cancer research work in England, and is being retained beyond the ordinary period of his study leave by Dr. Gye in connection with a line of research which shows considerable promise.

A useful part of the New Zealand organization has been the establishment and equipment of a radiophysics laboratory under the control of Professor White and Mr. Strong. This is also a research laboratory. Its special function is to calibrate the dosage of x-ray machines, the effect of which is to regulate and standardize dosage with a view to the best therapeutic results. The benefit derived from the work done in this radiophysics laboratory relates not only to the patients receiving treatment but also to the safety of the radiotherapists and nurses who operate the various plants. Radium has been bought as necessary, and that in unsuitable dosage or containers has been reconditioned.

The other activities of the New Zealand Branch are on more or less regular lines. Education of the public has not been neglected, and it has been done in such a way as to avoid cancer phobia. Perhaps the main practical activity has been the establishment of cancer clinics at the metropolitan hospitals. Before these clinics were established the treatment of cancer was unsatisfactory and rather haphazard. They have been active for approximately a decade, with the result that a considerable amount of statistical information has now been collected. This will lead to statistical research when data obtained in New Zealand are correlated with similar data in Australia. Funds of the Branch have been used for giving necessary financial assistance to friends or attendants proceeding with patients from country districts to the metropolitan cancer clinics. With regard to the collection and collation of statistics it has been found advisable at times to send a medical inspector to the provincial clinics mainly for the purpose of seeing that statistical forms are suitable and of uniform type and that details of the records are given full attention. An indication that the work of the New Zealand Branch of the Campaign has been satisfactory is that this body has the honour of controlling the organization and treatment of cancer with the full authority of the New Zealand Government and also of the hospital boards which administer the hospital system of the Dominion.—Reprinted from *Brit. M. J.*, 1939, 2: 135.

It is not enough that you should understand about applied science in order that your work may increase man's blessings. Concern for man himself and his fate must always form the chief interest of all technical endeavours, concern for the great unsolved problems of the organization of labour and the distribution of goods—in order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations.—Albert Einstein.

Medical Societies

The Academy of Medicine, Toronto

The annual dinner and stated meeting of the Academy of Medicine, Toronto, was held on October 3rd in Osler Hall, 13 Queen's Park, with an attendance of 153 Fellows and guests. Dr. D. E. Robertson, the newly elected President of the Academy, introduced to the Fellows a number of distinguished guests including the Hon. and Rev. H. J. Cody, President of the University of Toronto; Sir Robert Falconer, K.C.M.G.; His Worship the Mayor of Toronto; Colonel Hugh Cameron, District Medical Officer; Dr. F. S. Kennedy, President of the London Academy of Medicine; Dr. H. W. Whytock, representing the Hamilton Academy of Medicine; Dr. W. G. Trelford, President of the Academy of Dentistry, Toronto; and Dr. T. C. Routley, Executive Secretary of the Canadian Medical Association. Regrets were received from His Honour the Lieutenant-Governor of Ontario; the Rt. Hon. Sir William Mulock, P.C., K.C.M.G.; the Hon. Mitchell Hepburn, Premier of Ontario; the Hon. Harold Kirby, Minister of Health; Hon. L. J. Simpson, Minister of Education; and the Hon. Gordon Conant, Attorney-General of Ontario.

Dr. Cameron A. Warren, the immediate past President, was presented with a replica of the presidential badge of office. An innovation was established at this meeting when the winners were presented with the trophies for the Academy of Medicine golf tournaments.

The title of the President's inaugural address was "Soldiers and Doctors". The development of the Army Medical Corps was traced from the time when it consisted in a medical officer for each military unit. This medical officer was one who was very poorly trained in surgery or medicine. As time went on, in the British Army, the need for a better service became apparent, and eventually, at the beginning of the century, the British Army Medical Corps was formed. This now has the care of all enlisted men, from their service in the active fighting units at the scene of war to their treatment in hospitals at home following the war. The examination of recruits is one of the functions belonging to the Army Medical Corps, and it is of tremendous importance that none but the physically fit should be enlisted. None who have structurally weak physiques should be considered, as they are sure to be unable to endure the rigours of active service, and their breaking down on service means an embarrassment to the efficiency of the force; they and their dependants become a charge upon the government. None who have had diseases such as tuberculosis should ever be enlisted, as the heavy and difficult work of active service will cause a lighting up of the tuberculous lesion and they will be incapacitated. Any soldiers

who have succeeded in passing the examining boards and have been enlisted and who show in their first weeks of training any weakness or inability to stand the strenuous training should be discharged before the army becomes responsible for their condition.

The knowledge of military surgery is much fuller now than in 1914 or during the course of the last war. That war was not so long ago but that its lessons are still being studied, and surgery has benefited from these lessons, and one may look forward with assurance to a very high order of surgery. One must remember that the technique of surgery has improved a great deal in the last twenty years, and that there are now doctors who have had the opportunity of attending since the last war those cases who are unfortunate enough to have required treatment for their wounds or disabilities acquired on service. From this fuller knowledge of the needs of medicine and surgery in war time and with the experienced personnel that is available in Canada one would look forward to an early return of war wounded. Those who are to be in hospital for a considerable period could be sent to Canada relatively earlier than in the last war. This would be a saving to all concerned. Should the war develop as was anticipated some months ago and bombing become widespread and effective it might be possible to have hospitals in Canada for our wounded where they could be secure from the fear of bombing raids and have an undisturbed convalescence. Supplies and professional personnel could be made available in almost any quantity for hospitals located in Canada.

E. W. MITCHELL,
Honorary Secretary.

The Annual Meeting of the College of Physicians and Surgeons of Saskatchewan

The annual meeting of the College of Physicians and Surgeons of Saskatchewan was held at Moose Jaw, September 14th and 15th. One hundred and thirty members registered. At the business meeting the report of the committee which has been working with the provincial department of health regarding grants to physicians for treating relief patients was received. The doctors were classified as working in six different kinds of relief areas. Class A1 included the doctors who live in municipalities wholly on relief; they were allowed \$150 in fees and \$100 for mileage, as a maximum, that is, the fees they collected were reported to the government and subtracted from the grant. There were 81 doctors in this area; their average cash collections from September, 1938, to May, 1939, were \$54 a month, the average government grant was \$157, making an average monthly income of \$211.

Class A2 included 18 doctors in the marginal relief areas; they were allowed a maximum government grant of \$125 and \$75 for mileage; their average cash collections were \$81 a month; the average government grant was \$104, making an average income of \$185.

Class C included doctors living in the city doing work referred from relief areas. An average of 87 doctors a month received \$54. Class C1 included those in the larger towns, such as Swift Current, doing work on cases from relief areas. An average of 20 doctors received \$105 a month.

Extra area doctors included those living near the relief areas and doing work from those places. An average of 19 doctors received \$93 a month. In addition to these 7 doctors received \$45 a month for mileage only.

Total grants paid by provincial government from September to May for medical care of rural relief patients was \$208,410, but the value of care given patients was \$782,355, exclusive of mileage.

Since the province in general had good crops this year the only place that will be on total relief will be an area down the Arcola line, probably only about 60 municipalities.

Members of the committee in charge of the rural relief work, in conjunction with the provincial government, were Drs. B. C. Leech, W. A. Dakin and O. E. Rothwell. In charge of administration for the government was Dr. A. McMurchy. The feeling of the meeting, in spite of a few minor grumbles, was that on the whole the committee had done a satisfactory piece of work in new fields in an emergency situation.

A request was made by the Regina and District Medical Association for a loan of \$3,000 for one year for help in launching Associated Medical Services Incorporated, Regina; the plea was made on the ground that this was a new scheme of distinct educational value to all the members of the College, discovering costs of such service, amount of illness in any given community, and accumulating facts relative to the administration of health insurance plans. Dr. J. A. Valens, convener of the finance committee, pointed out that finances were in an unhealthy state; expenses were just a little larger than income received last year; but the members finally voted to make the loan.

In the evening Mr. Hugh Wolfenden spoke on "The development of health insurance throughout the world and its bearing on medical economics in Canada". While Mr. Wolfenden is an actuary he has the cautious outlook similar to that of a lawyer; one feels that he does not fling his opinions about carelessly. Every fact is gathered, every nuance studied, every eventuality foreseen; the material is collected, sifted, filed and tabulated by the skilled statisticians, then given more hours of study by the master; finally, an opinion emerges and by the validity of this opinion Mr. Wolfenden's professional

reputation stands or falls. The unheated influence of an actuary is a cool corrective for doctors who become emotional whenever they enter the field of economics.

When Dr. Roscoe Graham spoke on "The surgeon's responsibility in cancer" he covered a wide field. Using few words he painted a broad dramatic picture. As a surgeon he never forgets that he is always near human tragedy, his imagination lets him know what the patient faces before an operation, and after. He puts himself on a level with his audience by admitting his own mistakes; one feels they are not repeated. "Do the best that you know for your patient regardless of time spent in hospital, their economic worries are not yours"—something to remember next time Mrs. Smith wants to go home days before she should. Not so long ago surgeons were urged to be more radical in the face of suspected cancer; we have now completed the cycle. Dr. Graham made a plea for more conservatism, especially in breast surgery, "The painful breast is not the cancerous breast". In the afternoon his topic was "Cæcostomy, a simple and safe measure in diseases of the colon".

Dr. W. G. Cosbie spoke on "Cancer of the cervix". In the Toronto Clinic they are getting a larger percentage of late cases than they did a few years ago. He explained this by the fact that they are drawing on a larger area, getting patients from more remote districts. In the afternoon he spoke on "Maternal mortality" paying particular tribute to the good figures of the Victorian Order of Nurses. He did not feel that sulphanilamide had completely solved the problem of puerperal sepsis.

Dr. H. B. Cushing, in "Indications for and results of the removal of tonsils and adenoids", described their experiences in the Children's Memorial Hospital, Montreal. Some frivolous reasons given for doing this operation were, because the brothers or sisters were being done and it was convenient, because it was school holidays, because the school nurse said the tonsils should be out. They demand a complete physical examination before operation. Some parents object to this and take their children elsewhere. Cases refused operation because of other conditions were: a patient having a mediastinal tumour, one having leukæmia, and one having diabetes. The fact that no deaths followed 6,000 operations was attributed to the preliminary physical examination.

In the afternoon he spoke on "The principles of artificial feeding of infants". He took us back to the days when the infant deaths in orphanages were high. Many take the credit for the reduction of this high infant mortality.

Major W. L. Coke, Lt.-Col. E. A. McCusker, and Lt.-Col. R. H. MacDonald spoke on "Military medicine". Major Coke gave its history; Lt.-Col. McCusker outlined medical organiza-

tions on the field; and Lt.-Col. MacDonald described the set-up of a base hospital. In discussion Dr. R. G. Ferguson stated that all enlisted men should have a chest x-ray as part of their physical examination. This will probably be done in Saskatchewan.

Dr. W. M. R. Palmer, of Regina, showed a collection of medical stamps which aroused much interest among the medical historians. They were classified in groups as stamps showing (1) medical graduates; (2) scientists and benefactors; (3) hospitals; (4) cultism; (5) therapeutics; (6) allergy; (7) health promotion; (8) tuberculosis seals.

Moose Jaw lived up to its reputation for hospitality at teas and lunches for the members' wives who were, for the first time, invited to the annual medical banquet with its convivial social hour preceding the dinner.

LILLIAN A. CHASE

Letters, Notes and Queries

Biography of Dr. Harvey Cushing

To the Editor:

Mrs. Cushing has requested me to prepare a biography of her husband, and I should be most grateful to anyone who wishes to make letters, anecdotes or other memorabilia available.

Copies of all letters, no matter how brief, are desired, and if dates are omitted it is hoped that, when possible, these may be supplied (*e.g.*, from the postmark). If original letters or other documents are submitted they will be copied and returned promptly.

A new Medical Library building is being erected at the Yale University School of Medicine to receive Dr. Cushing's library and collections, including his letters, diaries and manuscripts. Any of his friends who wish, now or later, to present correspondence, photographs or other memorabilia for permanent preservation among the Cushing papers will receive the appreciative thanks of the University.

JOHN F. FULTON, M.D.

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Answers to letters appearing in this column should be sent to the Editor, 3640 University Street, Montreal.

It is stated by Benedict and Parmeter that the energy expended by the average person in walking up a flight of 15 steps is equal to that used in walking on the level 15 times the distance represented by the vertical height of such a staircase. Three times more energy is used walking up such a flight than walking down.

Abstracts from Current Literature

Surgery

Possibility of Differential Section of the Spinothalamic Tract. Hyndman, O. R. and Van Epps, C.: *Arch. Surg.*, 1939, 38: 1036.

In 1905 Spiller expressed his belief that there was an isolated tract in the spinal cord mediating pain. In 1911 Martin, at Spiller's suggestion, did the first chordotomy to relieve pain. This operation which has since come to be known as the Spiller-Frazier operation, or, more commonly, as chordotomy, has been done many times since its introduction and numerous reports have testified to its efficiency and value.

One of the authors has performed 41 chordotomies during the past three years and has seen reason to question the accepted location of the spinothalamic tract, as well as the accepted disposition of its fibres. They report the histories of six patients upon whom the operation was done with the patient under local anaesthesia only. Sections were made in the cord according to various patterns and cutaneous sensibility was tested at the operating table. The authors conclude that the spinothalamic tract mediating the sensations of pain and temperature extends from a point about midway from the dentate ligament to the anterior roots to a point about midway from the anterior roots to the anterior median fissure. As one progresses from the lower segments of the body upward the corresponding "pain fibres" are disposed more and more anteriorly in the cord. It is possible, therefore, by differential section to eliminate the sensations of pain and temperature in the chest and to retain these modalities in the lower extremities.

G. E. LEARMONTH

Studies on Spondylolisthesis. Friberg, S.: *Acta Chirurg. Scand.*, 1939, 82: Supp. LV.

The author gives a monograph on this interesting subject. His conclusions are at variance with some of the accepted teaching on this matter. There is a hereditary basis for this slipping, and in a small series of cases he has distinguished slipping at other than the presacral vertebræ; he hypothesizes the presence of two centres of primary ossification for each vertebral body as a distinctive factor. That is, rather than two centres for each body there are two ossification centres for each half-body. He collected 280 cases; 68 per cent occurred in the 5th lumbar region, and 32 per cent elsewhere in the vertebral column. About 10 per cent of the diagnosed cases were symptom-free. He found a traumatic basis in those only in whom an interarticular fracture could be demonstrated. Spina bifida was present in 28 per cent of the series. A relatively large number developed symptoms in their 'teen ages. The lumbosacral angle was larger than in the normal; the inclination of the upper sacral surface was

greater. The majority worked at heavy labour. One hundred and eighty-nine cases were re-examined one to eleven years after the first lateral x-rays; 142 not operated on and 44 cases operated on. In 10 cases not operated on there was further displacement; in the 44 operated on, no displacement. He believes the displacement may have been due to the lessening in thickness of the intervertebral disc, an ageing sign. He believes this condition has an hereditary basis and that slipping occurs only in 'teen years as a result of upright posture and increased weight-bearing, and that it does not occur in adult years except as an ageing phenomenon. Reduction by skin and wire traction influences the position but little; posterior (Albee) and anterior (transperitoneal) fixation act only as an "internal corset", although one must remember that the more severe displacements were the operative indication. Further follow-up re-examinations over a prolonged period are necessary before formulating an opinion as to conservative and operative treatment; he is not enthusiastic about operative interference.

FRANK DORRANCE

Results of Repeated Operations upon the Stomach especially for Gastrojejunal Ulcers. Finsterer, H.: *Surg., Gyn. & Obst.*, 1939, 68: 334.

After an experience with 2,433 resections of the stomach, of which 331 were for gastrojejunal ulcer, the author sets forth his conclusions. With perforated ulcers the acute may heal with simple closure, but the chronic demand resection for satisfactory results. During the past 20 years he has not done gastro-enterostomy with closure for perforated cases. He advises medical treatment on all gastrojejunal ulcers before doing resection. For inanition with gastroduodenal fistula complicating a gastrojejunal ulcer he uses a two-stage measure; the first is division and closure of the anastomotic loop and colon, and even this has its technical difficulties (3 of the 7 died); resection is performed later. He has found good results with Wilkie's method in which the colon is reunited at the first operation. In hæmorrhage he advises operation in the 24 to 48 hour period. He favours the use of local and splanchnic anaesthesia in these cases. He ranks Haberer's end-to-side gastroduodenostomy as second in results to the end-to-side Hofmeister-Finsterer gastric resection, but the latter must include from two-thirds to three-fourths of the stomach. Of the 331 cases of repeated operations the preceding operations were gastro-enterostomy, 190 cases (posterior, 7 per cent; anterior, 16 per cent); resection for exclusion, 20 per cent; and all others on a higher percentage. This list had an operative mortality of 12 per cent. Using the Hofmeister-Finsterer technique cure was obtained in 91 per cent; using the Haberer end-to-side gastroduodenostomy cure was obtained in 77 per cent. The disad-

vantages of the resection method are of little consequence. The recurrence of gastrojejunal ulcer following resection are due entirely to technical faults, the greatest of these being removal of too little acid-secreting mucosa.

FRANK DORRANCE

Mediastinal Emphysema as a Complication of Artificial Pneumoperitoneum. Banyai, A. L. and Jurgens, G. H.; *J. Thor. Surg.*, 1939, 8: 329.

Mediastinal emphysema developed in 7 cases (6 males and 1 female, at ages from 20 to 45) during artificial pneumoperitoneum treatment for pulmonary tuberculosis. It was relatively frequent (16.6 per cent) when the air was injected by the subphrenic route, in which the needle is inserted above the costal margin but below the costophrenic reflection of the pleura, and was not found when the sub-umbilical route was used. The authors think the air passes through the diaphragm and enters the mediastinum either (1) along the great blood vessels and œsophagus; or (2) via a needle puncture through the peripheral portion of the diaphragm, and thence by dissection under the basal parietal pleura. The most prominent symptoms were pain in and about the larynx, choking sensation, hoarseness, moderate or severe retrosternal pain, dyspnoea, difficulty in coughing and swallowing. These came on in from five minutes to five hours after the injection of the air, and disappeared in one to four days. In six of the cases there was palpable air in the anterior cervical region, which had extended along the trachea. They recommend that when air is subsequently injected into the peritoneal cavity only the sub-umbilical route should be used. Treatment is by bed rest, analgesics, sedatives, codeine or even morphine hypodermically. The precordial knocking or crunching sound recently noted by some authors is not mentioned.

C. C. MACKLIN

Obstetrics and Gynecology

The Therapeutic Value of Low-dosage Irradiation of the Pituitary Gland and Ovaries in Functional Menstrual Disorders and Sterility. Mazer, C. and Baer, G.: *Am. J. Obst. & Gyn.*, 1939, 37: 1015.

Low-dosage irradiation of the pituitary gland and ovaries resulted in restoration of the menstrual function in 59 per cent of 106 cases of amenorrhœa, 89 per cent of 18 cases of dysfunctional metrorrhagia during the child-bearing age, and in 57 per cent of 26 cases of dysfunctional menorrhagia. It had no effect in 3 cases of hypermenorrhœa. The amenorrhœa of 2 patients was presumably aggravated by the treatment. Low-dosage irradiation of the pituitary gland and ovaries in 26 women with normal menstrual cycles resulted in temporary amenorrhœa of one who, however, had in the past shown a tendency to amenorrhœa. Low-dosage irradiation

of the pituitary gland and ovaries is highly effective in sterility of women with functional menstrual disorders, but has very little, if any, effect in those who menstruate normally.

ROSS MITCHELL

Fetal and Neonatal Disease and Death. Adair, F. L. and Patter, E. L.: *Am. J. Obst. & Gyn.*, 1939, 37: 993.

Fetal and neonatal disease and death may result from hereditary factors. Environmental factors may operate upon the germ cells, embryo, and fetus prior to and during pregnancy. The environmental factors occurring during the onset and course of labour are extremely important in the causation of fetal and neonatal disease and death. Control of postnatal environment is especially important in preventing deaths of premature infants. It is obvious from studies of results obtained in certain areas that the unchanging level of fetal and neonatal deaths can be made to decline by providing proper care for the mother, fetus and newborn infant.

ROSS MITCHELL

Myomectomy in the Pregnant Uterus. Thomas, R. C.: *Brit. M. J.*, 1939, 1: 1085.

Three cases are reported in which pain was the chief symptom and operation was undertaken on this account. The actual condition found at laparotomy was, however, different in each case. In the first case, a primipara aged 30, with a twenty-two weeks' pregnancy, had a fibroid tumour of the right ovary about 4 inches in diameter, and in the left ovary a single cyst of similar size containing clear fluid. The fibroid and the two ovarian tumours were removed and the patient went on to term, when she had a spontaneous delivery of a child weighing 7½ pounds. In the second case a primipara aged 29 had a fibroid tumour, the size of a tennis ball, enucleated at the end of the fourth month of pregnancy, and she went on to spontaneous delivery at term of a child weighing 7 lbs. 13 oz. In the third instance a primipara of 31 years had an acutely tender swelling in the right iliac fossa and a history of three and a half months amenorrhœa. On laparotomy, the swelling was found to be due to a fibroid of like size to that in case 2 with a pedicle which had undergone torsion. She, too, did not abort, but was delivered of a child weighing 6 lbs. 10 oz. a week before term.

ROSS MITCHELL

William Blair-Bell Memorial Lecture—Uterine Inertia. Jeffcoate, T. N. A.: *J. Obst. & Gyn. Brit. Emp.*, 1938, 45: 893.

The author refers to parturition as beginning at ovulation and ending at involution. The hormones, corpus luteum and oestrogenic products not only promote increased vascularity and hypertrophy of muscle but also control its contractions and sensitivity of tone. The dilatation of the cervix is influenced by the even applica-

tion of the head in the lower uterine segment, giving adequate stimulation of nerve elements in this region. Inertia follows upon malposition in the lower uterine segment as in posterior positions. Correction of this malposition often allows inertia to pass off. The author encourages the use of oestrogenic products in those cases where morphia and chloral do not relieve the inertia. Estrone in one mg. doses was as effective as benzoate preparations in 2 mg. doses.

P. J. KEARNS

Study of Abortion Sequences. Malpas, P.: *J. Obst. & Gyn. Brit. Emp.*, 1938, 45: 932.

A large number of pregnancies end in abortion. Whitehouse gives 17.6 per cent, Mall 20 per cent, and Malpas gives 18 per cent. The author reviewed 2,000 fraternities. Most abortions were due to non-recurrent conditions, trauma, infection, transient metabolic and endocrine disturbances. In about one-half of the habitual abortions there is no abnormality beyond occasional evidences of endocrine or metabolic disturbance. The efficacy of vitamin E therapy in this group is open to criticism. At the moment progesterin represents the best method of treatment. Most of the young embryos which aborted had died from either maldevelopment or from early interference with their nutrition.

P. J. KEARNS

Ophthalmology

Pantocaine, the Cause of Professional Eczema among Oculists. Shimkin, N.: *Ann. d'Ocul.*, 1939, 176: 198.

Pantocaine is a new anæsthetic produced to replace cocaine. It is a derivative of novocaine, plus a radicle "butyl", the ethyl group being here replaced by the methyl group.

The author reports a case of palpable eczema after the instillation of 1 to 2 drops of a 0.5 to 1 per cent solution, which made itself evident two to three hours after by a burning sensation in the eyes, with redness and œdema of the skin of the lids. After six to eight hours a typical eczema of the lids appeared. This condition lasted from 8 to 14 days, but disappeared completely with treatment by cold compresses. A number of cases of eczema of the fingers, particularly of the nails, have been observed in oculists following the use of pantocaine.

The author himself suffered from eczema of the hands and of the left leg during four years' use of the drug in his clinic. The condition was completely corrected when the use of pantocaine was done away with. Other similar cases are cited.

S. HANFORD MCKEE

Contribution to the Study of Acquired Spasms of the Elevator of the Upper Lid. Jayle, G. E.: *Ann. d'Ocul.*, 1939, 176: 173.

This article, continued from the January number of the *Annales*, gives in detail one of

three cases seen by the author of mononuclear spasm of the elevator of the upper lid. He concludes: Spasm of the elevator of sympathetic or undetermined origin appears to be characterized by the following four features: (1) by involvement of the two lids or just the lower; (2) by the constant presence of a palpable phenomenon, such as exophthalmos; (3) by its frequent occurrence on a sympathetic endocrine basis; and (4) by the absence of signs tending to show a focus in the central nervous system.

Spasms of the elevator of the lids, binocular or monocular, permanent or intermittent, possess therefore a histological characteristic and also certain pathogenic ones. From the histological point of view are to be noted an elective localization of spasm of the upper lid, its habitual association with oculo-motor disturbances, its frequent association with signs of a focal peduncular lesion, among which vestibular and postural troubles have an important place. From the pathogenic point of view they are characterized by: their origin; the focus of the lesion in the upper peduncular region or sub-peduncular (with perhaps an exception for certain of the syncinetic monocular spasms); their mechanism; probable disturbances of functional association at the site of the elevator of the lid.

S. HANFORD MCKEE

Endocrinological Reports on Retinitis Pigmentosa. Biro, E.: *Ann. d'Ocul.*, 1939, 176: 293.

It is only within the last ten years that pigmentary degeneration of the retina has been investigated through the endocrinological viewpoint. Up to this date most research has been along anatomico-pathological lines, where one sought in the histological study a satisfactory explanation of the cause of the pigmentary retina. Investigators of the last thirty years have searched and are still seeking to find if the displaced pigment is of choroidal or retinal origin, and whether the first changes in the disease are in the choriocapillary layer of the choroid or in the neuro-epithelial one of the retina.

The author's ideas on the etiology have been influenced by the finding of bands among the endocrine glands and in the pigmented retina. Experimental research is being continued with sex-hormone preparations and with liver extracts. These experiments and their results are to be published in future.

S. HANFORD MCKEE

Neurology and Psychiatry

Dependence of Sensation of Pain on Cutaneous Impulses. Hollander, E.: *Arch. Neurol. & Psychiat.*, 1938, 40: 743.

In succinct fashion the author describes the results obtained by the anæsthetization of painful cutaneous zones resulting from visceral or somatic foci. A wide variety of cases were

treated—herpes zoster, subacromial bursitis, sacro-iliac sprain, lumbago, carcinoma of stomach and gall-bladder—each one giving rise to localized cutaneous pain. The anæsthetic used was 3 per cent ethyl aminobenzoate, 5 per cent benzyl alcohol and 1 per cent phenol in expressed oil of almond, U.S.P. This was injected in wheel-spoke fashion, the volume varying from 0.5 to 10 c.c., depending on the size of the area involved. Marked relief was obtained in all 26 cases.

As explanation a modification of the theory of Sir James Mackenzie is advanced. An irritable focus develops in the central nervous system when it is bombarded with stimuli from some inflamed visceral or skeletal structure, which lowers the threshold for afferent impulses from the ectoderm entering the system at the level of that focus. Thus it would appear that the sensation of pain is dependent on cutaneous impulses. On a phylogenetic basis it would appear reasonable that the protective mechanism of pain sense should be confined to the surface of the body and mediated through the nervous system, which is, of course, of ectodermal origin.

G. N. PATERSON-SMYTH

Adie's Syndrome. Heersema, P. H. and Moersch, F. P.: *Proc. Mayo Clinic*, January 11, 1939.

This excellent review of a fascinating and baffling problem fills a long felt want in neurological literature. Adie's original report covered 23 cases; the present writers found 57 in the Mayo files from 1915-37.

Adie's syndrome consists of the so-called tonic or myotonic pupil associated with absence of the deep reflexes. The main significance of this condition is the very obvious possibility of a mistaken diagnosis of syphilis, with its train of drastic consequences to the patient. The differential diagnosis between tabes and an Adie's syndrome should not prove difficult if the neurological examination be thorough.

The myotonic pupil differs from the Argyll-Robertson pupil in certain important ways. (1) The tonic pupil tends to be unilateral and larger than normal, the Argyll-Robertson bilateral and miotic. (2) The tonic pupil reacts very slowly to convergence and accommodation, while the Argyll-Robertson reacts briskly. (3) Mydriatics act normally on the tonic but very poorly on the Argyll-Robertson pupil. The areflexia of Adie's syndrome is unaccompanied by the sensory changes which constitute such a prominent part of the clinical picture of tabes, and the serological examination completes the differentiation.

No plausible explanation of the etiology and pathogenesis of Adie's syndrome has as yet been advanced, though many suggestions have been made. Clinically its importance lies in the differentiation from tabes. The condition is entirely benign; cases have been followed for

periods up to 27 years with no evidence of progression. No treatment is required beyond reassuring a patient who may well be concerned over the possibility of syphilitic infection.

G. N. PATERSON-SMYTH

Compression Fracture of the Spine in Epilepsy.

Ziskind, E. and Somerfeld-Ziskind, E.: *Bull. Los Angeles Neurol. Soc.*, 1939, 4: 45.

The possibility of fractures from convulsive spasms has become a matter of increasing importance since the introduction of metrazol convulsive therapy for the psychoses. The authors report three cases of compression fractures of vertebrae which occurred during spontaneous major convulsive seizures. All of these patients were men over forty, and the fractures involved the lower thoracic and lumbar vertebrae. The history of the attacks seemed to exclude the possibility of direct impact and pointed to excessive muscular contraction as the cause of fracture. Such cases have previously been reported in cases of tetanus, although in tetanus the compression fractures have occurred almost entirely in the fourth to sixth thoracic vertebrae.

FRANK TURNBULL

The Pituitary Adenomata. Henderson, W. R.: *Brit. J. Surg.*, 1939, 26: 811.

This paper is a very comprehensive report of the early and late surgical results of Dr. Harvey Cushing's Brigham Hospital series of 338 verified pituitary adenomata. The operations took place over a twenty-year period (1913-1932). All but three of the patients were followed continuously after operation. The operative mortality rate was 5.3 per cent for transphenoidal operations and 4.5 per cent for intracranial operations. Six months after operation 65 per cent of the patients had resumed their normal work. The late results indicate great variability in the rate of growth and behaviour of the tumours. Post-operative x-ray therapy proved beneficial, and the transfrontal operation was shown to be superior to the transphenoidal operation in so far as late results were concerned. There were 44 secondary operations for recurrence of symptoms, and the results were in all respects as good as those following primary operations. Cystic adenomata could not be distinguished clinically from solid tumours. The most serious objection to the transfrontal operation was post-operative clot formation which occurred in 14 per cent, and frequently necessitated re-opening of the operative wound. Of the 338 tumours 260 were chromophobe adenomata, 67 acidophil adenomata, and 11 adenocarcinomata. The operation mortality rate was slightly higher for the acidophil tumours, but the late surgical results appeared to be better. In these acromegalic patients operation usually produced marked improvement in vision, but generally had little effect on the severe headaches. Some of the adenocarcinomata be-



SEROTHERAPY or CHEMOTHERAPY ?

Finland, Spring, Lowell and Brown*, and others, have shown that, in the treatment of pneumococcal pneumonias, both forms of therapy are essential to ensure optimum results.

In treating a group of elderly patients of a high bacteremic incidence of fifty per cent, they* obtained a mortality rate of only 22% through the combined use of specific sera and sulphapyridine . . . in similar groups treated without specific sera or drugs they had previously found that a fatality rate of between 75% and 90% was to be expected.

Since the reported mortality rate in such groups is usually between 50% and 60% when either specific serum or sulphapyridine is used alone, it can be fairly stated that combined serotherapy and chemotherapy offer the most effective therapeutic approach yet devised for the treatment of pneumococcal pneumonias.

*Finland, M., Spring, W. C., Lowell, F. C., and Brown, J. W.: Ann. Int. Med. 12:11, 1816 (May) 1939.



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haved like chromophobe adenomata, but others were hopelessly malignant, infiltrating the base of the skull and producing multiple cranial nerve palsies.

FRANK TURNBULL

Therapeutics

Surgical Treatment of Carcinoma Cervicis Uteri by the Radical Vaginal Method. Mitra, S.: *J. Obst. & Gyn. Brit. Emp.*, 1938, 45: 1003.

The author describes his method of dealing with carcinoma of the cervix—operation with pre-operative and post-operative radiation. He gives statistics of 82 operative cases: 4 in grade I, 46 grade II, 32 grade III. The primary mortality was 4.87 per cent. The bladder was injured in three cases, the rectum in two. In 10 per cent the perineal wound did not heal by primary intention. In 54 per cent *B. coli* infection of the local tissues followed. In 4 cases pyometra was present. The author does not give a five-year follow-up. In order to get satisfactory results the whole question crystallizes into the proper selection of cases, a complete radical operation, and the proper systematic post-operative irradiation up to one year.

P. J. KEARNS

Pathology and Experimental Medicine

The Treatment of Addison's Disease with Desoxy-corticosterone Acetate, a synthetic Adrenal Cortical Hormone. (Preliminary report). Thorn, G. W., Howard, R. P. and Emerson, K., Jr.: *J. Clin. Investigation*, 1939, 18: 449.

It was found that intramuscular injections of synthetically prepared desoxy-corticosterone acetate appeared to reproduce in patients with Addison's disease all the known effects of treatment with potent adrenal cortical extracts. It was found possible to maintain patients with Addison's disease in excellent condition by means of this treatment without the exhibition of added sodium chloride.

JOHN NICHOLLS

Sulfapyridine, Sulfanilamide and Specific Antiserum in Experimental Type III Pneumococcic Infections. Cooper, F. B., Gross, P. and Lewis, M.: *J. Clin. Investigation*, 1939, 18: 423.

These authors found that sulphanilamide and sulfapyridine were equally effective against Type III experimental pneumococcic meningitis and pneumonia of rats, whereas sulfapyridine was somewhat superior in Type III pneumococcic sepsis of mice. Neither drug was effective against a total of more than 100 fatal doses. Specific Type III pneumococcic rabbit antiserum was as effective as these two drugs except in the meningitis of rats, where it had no therapeutic effect.

The rats which recovered from pneumococcic pneumonia showed slight immunity, which was

least marked in those treated with sulfapyridine. No appreciable immunity was demonstrable in the rats which recovered from pneumococcic meningitis, irrespective of their previous therapy. Sulfapyridine-treated mice which recovered from pneumococcic sepsis possessed less immunity than sulphanilamide-treated mice. In either group this immunity was not sufficiently great to save all mice reinfected with 100 fatal doses of homologous culture.

JOHN NICHOLLS

Didelphys in Sisters. Tyler, G. T.: *Am. J. Surg.*, 1939, 45: 337.

Congenital malformations have been ascribed to many different causes, among which constitutional defects in the germ plasm itself are seldom considered, for the reason that they usually occur in but one child in the family. Occasionally, however, we do find more than one child in the family affected with some abnormality, which forces us to look upon the germ plasm itself as responsible. Tyler reports the case of two uterine horns in sisters, both of whom were exceedingly well developed for their ages. He operated upon the first sister at 12 years, to remove the right horn of the uterus, which ended blindly in a dilated sac just before connecting with the vagina. Owing to uncontrollable hæmorrhage, he was forced to remove the entire uterus. A few months later a fourteen year old sister came with the same history of persistent bleeding that had brought the younger girl in. Examination again disclosed a uterus with two horns, the left alone being connected with the vagina. The right horn only was excised in this case. The mother of these girls, normal herself, had two first cousins, one the daughter of her mother's brother, the other the daughter of her mother's sister; both cousins had a condition similar to Tyler's two patients. In one the condition had not been discovered until she was delivered of her first child; the other cousin had been operated upon before she had any children.

MADGE THURLOW MACKLIN

Similar Goitres in Monozygotic Twins. Neel, H. B.: *Surgery*, 1939, 5: 582.

Disease in twins continues to furnish interesting reports. Neel records two instances of the same type of goitre in identical twins. In the first pair, whose maternal grandmother and great mother were both said to have had enlarged thyroids, the onset of the disease was at about the same time in both, and the thyroids grew at about the same rates, so that at the time the girls were 15 the thyroids were about the same size. The goitres were removed, and the histological pictures were practically identical in both cases. Neel reports a second instance of the same type of goitre in identical twins. In this pair the time elapsing between the noticeable growth of the thyroid was four years. Here again the histological picture was similar in the removed thyroids.

MADGE THURLOW MACKLIN

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Hygiene and Public Health
Can Lead Poisoning Cause Gastric-duodenal Ulcers? Csepai, K.: *J. Indust. Hyg. & Toxicology*, 1938, 20: 521.

The possibility of the development of gastric-duodenal ulcer caused by lead poisoning has been suggested more than once during the last few years. In the opinion of Csepai this supposition can only be justified if exact observation proves that this disease occurs more frequently among lead poisoned persons than among others. In the Central Diagnostic Station of the Hungarian Social Insurance Institute a great number of patients suffering from gastric ulcer are examined every year. An analysis of 1,611 cases of gastric ulcer among 8,975 occupied persons is given. Lead workers showed an incidence of 8.8 per cent; builders showed an incidence of 20.7 per cent; and the average incidence of gastric ulcer among the 8,975 persons was 17.9 per cent. Evidently these figures do not support the view that gastric ulcer is related to lead poisoning.

FRANK G. PEDLEY

The Physician and Tuberculosis. Myers, J. A.: *J. Am. M. Ass.*, 1939, 113: 189.

Myers states that 80 to 85 per cent of cases of tuberculosis are well advanced before significant symptoms appear. It is, he says, possible to detect tuberculosis within 3 to 7 weeks of the entrance of the tubercle bacilli into the body by means of the tuberculin test. This test, he thinks, should be performed yearly in negative reactors.

A tuberculin reactor is a potential subject for the reinfection form of tuberculosis, and it is important, particularly in the young adult, to determine whether clinical tuberculosis is developing in the lungs of tuberculin reactors. Pulmonary tuberculosis develops so rarely in young adolescents that there is no need to examine the lungs carefully in this age-group. Suspicious shadows may be found by x-ray examination on an average 2 or 3 years before the disease presents symptoms sufficiently serious to cause the patient to seek medical advice. Only a small proportion of tuberculin reactors show signs of disease at any one time. Therefore x-rays should be repeated annually. Myers thinks that any immunity which may develop from the primary complex is undependable and that attempts to produce immunity artificially produce very questionable results.

The primary complex in children is resisted so well that it requires no treatment whatever. It is difficult, therefore, to justify the provision of preventoriums or children's buildings on sanatorium grounds. The primary complex is also borne well by adults and the real danger of the primary infection in adults is its effect in sensitizing the individual to the tuberculo-protein. "Indeed the reinfection type of tuberculosis causes nearly all the illness and death from this disease."

The author suggests nine procedures which should be followed in a control program. These include routine tuberculin testing of everyone, x-ray films of reactors, adequate hospital facilities, follow-up of arrested cases, cooperation with veterinarians in the control of the disease in animals.

FRANK G. PEDLEY

Obituaries

John Alexander Macgregor, M.D., F.A.C.P., F.R.C.P.(C.), LL.D.—The death of Dr. John A. Macgregor occurred suddenly on September 20, 1939. For many years he had been a leading figure in the medical profession of Ontario, particularly the part of the province known as Western Ontario. He graduated in 1892 from the University of Western Ontario. After practising for a time at Kent Bridge, Ont., and later at Minden, Nebraska, he returned to London in 1905, established a practice, and founded the systematic teaching of pathology and bacteriology in the University of Western Ontario Medical School. Later, he became associated with the Department of Medicine and was appointed Professor of Medicine in 1920. Although his main interest was in clinical medicine, he never lost touch with the basic sciences. He thought and spoke in terms of pathology and physiology, not from any assumed interest but from a fundamental knowledge of these subjects. It was this attitude, combined with a natural ability to impart knowledge at the bedside, which made his teaching so valuable and appreciated.

An indefatigable worker, an extensive but discriminating reader, Dr. Macgregor kept abreast of the latest developments in the field of medicine. His sound judgment and common sense caused his advice as a consultant to be much sought after throughout the whole of Western Ontario. Although he became Professor Emeritus in 1925, his interest in the Department of Medicine and the University as a whole never waned. He generously supported students' organizations and upheld the principles of organized medicine, having been past President of the Ontario Medical Association and of the London Academy of Medicine. For many years he was an examiner for the Medical Council of Canada.

Dr. Macgregor abhorred publicity, show and formality. Therefore he never sought honour for himself but he was a source of inspiration and counsel to numerous young medical men. He will long be remembered by many graduates of the University of Western Ontario and others as a friend, a stimulating teacher, and an exponent of the highest traditions of medicine. He lived an exemplary life and he died as he always wished, while still actively engaged in his beloved profession.

E. M. WATSON

Dr. David Archer, of Oshawa, Ont., one of the senior members of the Ontario County Medical Association, died on September 20, 1939. Born in Cartwright Township, Durham County, on August 4, 1857, David Archer, son of Mr. and Mrs. Robert Archer, attended Bowmanville High School, Hamilton Model School, and then started his career as a teacher of mathematics at Smith's Falls High School. Later he entered the study of medicine at Victoria College and after graduation (M.D., 1889; M.B., University of Toronto, 1890) went to England, Scotland and Ireland where he took post-graduate work in Dublin and Edinburgh. Coming back to Ontario county, he opened a practice at Port Perry where he continued for 37 years before coming to Oshawa in 1928. He was a member of the medical staff of the Oshawa General Hospital and held in high regard by the medical fraternity there. At a banquet

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of the Ontario County Medical Association held at the Genosha Hotel on February 23, 1938, Dr. Archer, along with three other senior practitioners of the county, was presented with a life membership in the Association.

Dr. Edwin Bromley, of Sault Ste. Marie, Ont., died on February 15, 1939. He was a graduate of Victoria University (1886).

Dr. William F. Bryans, practising physician in Toronto since 1890, died on September 28, 1939, in his seventy-eighth year. Born in Arthur, Ont., he taught school for seven years before going into medicine. He was a graduate of the University of Toronto (1890). He was an associate member of the staff of the Toronto Western Hospital, and a member of the Academy of Medicine.

Dr. Joseph B. Chambers, a former medical superintendent of Brandon and Selkirk Mental Hospitals, died at Los Angeles on September 22nd, at the age of eighty-two. He graduated from Victoria College, Cobourg, in 1880; came to Winnipeg in 1882, and practised law there and in Glenboro until 1895, when he entered Manitoba Medical College, and graduated in 1898. He practised at Elgin until 1907 when he joined the staff of the Brandon Mental Hospital. He moved to Los Angeles in 1925. He was a veteran of the Riel Rebellion.

Dr. James Dodd Dixon, of Lachine, Que., died on September 27, 1939, at the Ross Pavilion of the Royal Victoria Hospital, Montreal, in his sixty-first year.

Spending his entire career in Lachine, Dr. Dixon took a special interest in health and education and was the benefactor of the community in many ways in these two fields. Born in Montreal, he was educated at St. John the Evangelist School and later studied medicine at McGill University, graduating in 1902. He greatly distinguished himself in sports, particularly in track events. After graduation he was house surgeon at the Royal Victoria Hospital, then began to practise medicine in Lachine, specializing in surgery. He was one of the founders of the Lachine General Hospital, where he was chief surgeon, and was largely instrumental in having the new Lachine High School built. He was also head of the Lachine Health Board and was attached to St. Joseph's Hospital, Lachine. Some years ago he was elected a Fellow of the American College of Surgeons.

Dr. William Duff Forrest, of Halifax, N.S., died on September 12, 1939. Death came suddenly following a heart attack. He was in his sixty-sixth year. Dr. Forrest was the son of Rev. Dr. John Forrest, revered president of Dalhousie University, and was born in 1874. He took a science degree at Dalhousie and graduated from there in medicine in 1898. In London he did post-graduate study, taking the degrees of M.R.C.S. and L.R.C.P. In 1901 he returned to Halifax where he practised till his death.

Apart from his long years of practice Dr. Forrest's interests were many. He was chairman of the City Health Board, a position he had held since 1925. He also served as health officer for the County of Halifax, a post in which he was active for twenty years. In the Provincial Legislature he served as a member for Halifax. His interests were particularly felt in the work of the Anti-Tuberculosis League and in the Social Service agencies. He was president of the North British Society, a member of the Red Cross Society, the Commercial Club, and his local and Dominion medical societies. The loss of his work and his personality is felt keenly in many spheres.

Dr. M. A. Griffith, of Lintlaw, Sask., died on August 9, 1939. He was a graduate of the University of Manitoba (1904).

Dr. John Francis Macaulay, of Castalia, Grand Manan, N.B., died at his home on September 17th. Dr. Macaulay was a native New Brunswicker. He was born in 1876, graduated in medicine from McGill University (1898) and had practised all his life in New Brunswick, first as an intern at the Saint John General Hospital and later on the Isle of Grand Manan. Dr. Macaulay had a peculiarly appealing personality and was much beloved by the populace whom he served as a physician. Dr. Macaulay was the son of the late John Macaulay, of Sussex, N.B.

Dr. Lionel John Samuel Sicard, of Buckingham, Que., died on September 21, 1939. He was born in Buckingham in 1894, the son of Dr. J. D. Sicard. He graduated from Buckingham High School, and received his M.D., C.M. at McGill University (1919). He had been practising in Buckingham since 1920, and took over his father's practice when the latter died seven years ago. Dr. Sicard was a member of the staff of St. Michael's Hospital at Buckingham.

Dr. A. F. Warner, of Toronto, Ont., died on June 28, 1939. He graduated from Queen's University in 1887.

Joseph Wilkinson, pioneer doctor of the Govan District, died in Regina on September 17, 1939, at the age of seventy-four years. He had resided in Regina since his retirement in 1938. Born in England, he came to Canada at the age of six years with his parents and settled first in Ingersoll, Ont. He later moved to Manitoba, where he took up homestead. In 1898 he graduated in medicine from Manitoba University and established a practice in Roland, Man., until 1916, when he moved to Govan.

News Items

British Empire

The Sixth Australian Medical Congress planned to be held at Perth, Western Australia from September 2 to 7, 1940, has been postponed indefinitely.

Alberta

At the last meeting of the Council of the College of Physicians and Surgeons of Alberta this body went on record that it was in the interest of medical education that the medical graduates employed by a university should be in close touch with organized medicine, and therefore should be members of the College of Physicians and Surgeons of the province where employed.

The Council agreed that if vital statistics were to be of the most value the cause of death should be stated as nearly as possible in a definite manner. To accept the report from some one other than a medical man was unsatisfactory. In some provinces, postmasters are paid twenty-five cents for reporting. The cases are not investigated, but reported from the information of neighbours.

The following physicians have registered in Alberta recently: Alfred Spencer Turner, Edmonton, Alta.; Robert Douglas Cameron, Three Hills, Alta.; Thomas James Roulston, Regina, Sask.; Georges Philippe Fortier, Trochu, Alta.; Howard Percival Snyder, Bound Brook, N.J.; Milton Lewis Randolph Hersey, Montreal, Que.

G. E. LEARMONTH

British Columbia

A questionnaire is being sent from the British Columbia Medical Association offices to every man in practice in the province, dealing with national service,



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—*J. A. M. A.*, 106: 602, February 22, 1936.

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and asking the men to register: this in accord with the action instituted by the Canadian Medical Association all over Canada. So far the response is very prompt and we believe it will be a very full one. This would seem to be a very wise move on the part of our parent Association. It should help to avoid confusion and overlapping, and to guide men as regards the way they can best serve, as we all want to do. Dr. G. F. Strong, of Vancouver, represented British Columbia at the meeting in Ottawa.

The Annual Meeting of the College of Physicians and Surgeons of British Columbia was held on September 18th, and the Council gave an account of its work during the past year. J. H. MACDERMOT

Manitoba

A new district medical society has been formed in northern Manitoba including the towns of The Pas and Flin Flon.

Considerable damage by fire was done to one of the auxiliary buildings of the Portage la Prairie General Hospital on September 17th, but the patients were not affected. ROSS MITCHELL

New Brunswick

On September 24th, at Fredericton, a monument was unveiled to the memory of the late Hon. Dr. W. F. Roberts, the first Minister of Health in the British Empire. The monument was unveiled by Hon. J. B. M. Baxter, chief justice and administrator of New Brunswick. Eulogies were pronounced by the Liberal leader, A. A. Dysart, and the Conservative leader, F. C. Squires. The first ministry of health was advocated in 1918 by Hon. Dr. Roberts, and in the same year it was established with himself as the first minister. The monument was presented to the Province by Dr. J. C. Webster, C.M.G., on behalf of the Historic Sites and Monuments Board of Canada. The organization by Dr. Roberts has gone steadily forward year by year and has been supported by whatever political parties were in power. The most lasting monument, however, to the late Dr. Roberts is the improved condition of the people of his native province.

The Provincial Advisory Committee (on military medical affairs, Ed.) of the New Brunswick Medical Society, Canadian Medical Association, New Brunswick division, was organized at a meeting held in Saint John on October 5th. The following committee was appointed: Temporary Chairman, Dr. W. E. Gray, Milltown; Temporary Secretary, Dr. A. S. Kirkland, Saint John. Other members of the committee include the members of the entire executive committee of the New Brunswick Society with the addition of Lieut.-Col. D. C. Malcolm and a special health representative who will be appointed shortly.

Hon. Dr. Murray MacLaren, Lieut.-Governor of New Brunswick, continues to improve, following his accident of some weeks ago. A. S. KIRKLAND

Nova Scotia

Military work is already making heavy demands on the medical profession of Halifax and the province. The 22nd Field Ambulance unit, stationed at Halifax, consisting of Lt.-Col. V. O. Mader, Major G. R. Burns, Capt. G. A. Winfield, Capt. C. M. Jones, Capt. E. F. Ross, and Lieut. Carl Trask, is operating on a full time basis. Lt.-Col. J. G. D. Campbell and Lieut. Harold Robertson are attached to headquarters. Also working with their units are Major T. M. Sieniewicz, Capt. Arnold Noble, Capt. C. M. Bethune, Capt. Charles Elliott, Capt. Ray MacLean, Capt. Donald Rankin, and Lieut. Jack Miller. With the Royal Canadian Navy is Dr. Carl Stoddard, and Dr. Harry Morton, of Montreal. Dr. Harvey Hebb has been accepted for service with the

Royal Navy. Throughout the province, Dr. Hugh MacKay, of New Glasgow, Dr. B. F. Miller, of New Waterford, Dr. James Sutherland, of Amherst, Dr. B. W. Skinner, of Mahone Bay, Dr. Samuel Marcus, of Bridgewater, and others have been called out. Medical boards have taken the services of a far greater number from civilian practice.

The bed capacity of the Cape Breton Hospital is to be increased by a 126-bed annex to cost in the neighbourhood of \$200,000.

Dr. S. H. Keshen has been appointed to the City Health Board of Halifax, to fill the vacancy made by the death of Dr. W. D. Forrest.

Dr. Graham Simms and Dr. Eldon Eagles have obtained leave of absence from the Provincial Department of Health to do post-graduate work in public health.

Major G. R. Burns conducted a series of lectures before the Halifax Medical Society on the medical treatment of gas casualties. ARTHUR L. MURPHY

Ontario

At the fifth biennial convention of the Canadian Hospital Council at the end of September, Dr. George Stephens, of Winnipeg, was re-elected *President*, with Dr. G. Harvey Agnew, Toronto, *Secretary*.

The University of Toronto announced that Dr. C. H. Best, Professor of Physiology, has been awarded the Baly Medal of the Royal College of Physicians. This medal is presented to the British scientist believed to have made the most distinguished contribution to physiology. Doctor Best has also been invited to deliver the John Mallet Purser Lectureship at Trinity College, Dublin.

The Nurses' Home in connection with the Memorial Hospital at St. Thomas was opened on September 13th. At a cost of about \$55,000, it will house approximately sixty members of the training school.

The family of the late J. W. Scott, of Listowel, has presented to the Listowel Hospital the family property, which consists of five acres of land and a beautiful residence with dimensions 95 by 65 feet. At the last municipal election a by-law was passed authorizing a grant of \$10,000 toward improving and enlarging the old hospital. It is hoped that it will be possible to apply this amount to necessary alterations in the new building. J. H. ELLIOTT

Quebec

Dr. E. W. Archibald, Emeritus Professor of Surgery at McGill University and formerly chief surgeon of the Royal Victoria Hospital, has been appointed to serve on the Trudeau Medal Committee of the U.S. National Tuberculosis Association for the 1940 award.

Dr. Archibald is recognized internationally as an authority on the treatment and prevention of tuberculosis and has developed surgical techniques which have come into wide use.

The Seventh Annual Clinical Convention of the Montreal Medico-Chirurgical Society was held in Montreal from October 4th to 7th. The sessions were held in five different hospitals, providing for a wealth and variety of clinical material which would be hard to excel. The opening meeting was at the Children's Memorial Hospital, where demonstrations and lectures occupied the morning. The afternoon was spent on a long program at the Montreal Neurological Institute. On the following day the members met at the Royal Victoria Hospital and attended a variety of clinics. Round-table discussions were arranged, to fill in the

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afternoon. The same type of program was followed at the Montreal General Hospital on the third day, and on Saturday morning a series of demonstrations was held in the Royal Victoria Montreal Maternity Hospital. The attendance was excellent, although the war conditions played their part in limiting the numbers. The hospitals again extended their very highly appreciated courtesy in providing buffet luncheons each day, which action was much appreciated.

The annual banquet of the Society was held in the evening at the Mount Royal Hotel, at which professor W. D. Woodhead, of the Classical Department of McGill University, gave an excellent talk on "Humour". Dr. Gérin-Lajoie also led the gathering in the singing of the old-time favourite "Alouette".

We look forward each year to the conventions, which have firmly established their place in our professional calendar.

United States

Following a request to the Canadian Custodian, the Montreal office of Merck & Co. Limited, a subsidiary of Merck & Co. Inc., manufacturing chemists of Rahway, N.J., has received official notification from the Department of the Secretary of State, Ottawa, through the office of the Custodian, that neither Merck & Co. Inc., nor Merck & Co. Limited, are connected with any foreign concern on the British "blacklist".

The recent press despatch from New York included the name of "the Merck chemical company" among several hundred foreign concerns on the "blacklist" of the British Government. Subsequent publication of the official list in full disclosed that the company referred to was "Casa Chimica Merck" of Brazil and "Merck Quimica Argentina" of the Argentina, South America.

Commenting on this situation, George W. Merck, president of Merck & Co. Inc., stated that the Rahway concern is an American company, incorporated under the laws of New Jersey; that its officers and directors are American citizens; that more than 99½ per cent of the stock is owned by approximately a thousand people in all walks of life, residing in the United States and Canada; that the company has no corporate connection with any concern outside of the United States, with the exception of its wholly-owned Canadian subsidiary, Merck & Co. Limited of Montreal; and that no foreign concern has any interest in Merck & Co. Inc.

Merck & Co. Inc. manufactures and distributes nearly 3,000 drugs and chemicals for the medical, dental, pharmaceutical and allied professions; for various branches of industry, and the general public.

General

It was announced on September 5th that Germany is closing all but four of her universities—Berlin, Vienna, Munich, and Jena.

Book Reviews

Shock and Related Capillary Phenomena. V. H. Moon. 442 pp. \$3.50. Oxford University Press, N.Y., 1939.

This book does not present any facts in regard to shock that were not known, but it does make a thoughtful and careful attempt to integrate our knowledge of the condition. The author lays a foundation for his argument by a presentation of the physiology of the capillaries so far as it is understood at present. On this he bases his thesis that the primary disturbance is a change in the permeability of the endothelium of the capillary wall. This allows the plasma of the blood to escape from the vessels, with concentration of the blood as a result and, if loss of fluid continues, stasis with the capillaries packed with corpuscles. The cells of the tissues are deprived of

oxygen with lessening of their metabolism and alteration in its character as a consequence. This reduces blood flow still more and a self-perpetuating vicious circle becomes established.

Shock is defined thus: "Shock is a circulatory deficiency, neither cardiac nor vaso-motor in origin, characterized by decreased blood volume, decreased cardiac output (reduced volume flow) and increased concentration of the blood". It is pointed out that arterial blood pressure is not a reliable indicator that shock is developing. Concentration of the blood appears early, is easily determined, and is seen before variations in blood pressure occur. For these reasons it is useful as an indicator. The morphological changes present in shock are described. The list of conditions in which shock is described as the terminal state is too long to give here. These include various agents acting on the systemic circulation, such as mercury, arsenicals, and venoms; burns; metabolic intoxications; infections, such as diphtheria, cholera and influenza; and abdominal emergencies.

The last section is entitled "Practical Considerations" and it is just that. This part of the book at least might well be read by every practitioner of medicine to the advantage of himself and of his patients. Altogether, the book is pleasingly written. One may feel that the vicious circle, hæmoconcentration, and the fallibility of arterial blood pressure are mentioned too often, but that may be necessary to drive home the points that the author wishes to make.

End-results in the Treatment of Gastric Cancer. E. M. Livingstone and G. T. Pack. 175 pp., illust. \$3.00. P. B. Hoeber, New York, 1939.

This is an analysis of 14,000 gastrectomies for cancer performed during the last half century, reported by surgeons of the world. Conclusions are shown in graphic tables and charts which are easily deciphered. It is not a book for the general practitioner, aside from the parts which show the importance of early diagnosis. However, the book should have a place in every library, clinic, and well organized hospital.

As stated in the foreword, one must conclude, if the records of the past in this field are to be relied upon, that the organized team work and a skilled staff of a well-equipped institution can as a rule produce results not to be expected from the casual surgeon. It is obvious that experience and courage are necessary to obtain the best results.

The general mortality for gastrectomies is still high, but in some instances has been as low as 5 to 7 per cent. The survey shows that the result of gastrectomies in all hands is less than 3 per cent living at the end of five years. On the other hand, it shows that where cases have been resected without finding of nodes, and where the carcinoma is of Grade I and II, 50 per cent have been alive at the end of five years, as reported by Balfour.

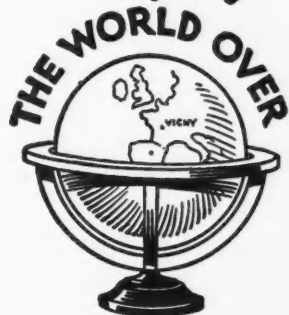
The surgeon's reaction to this book, in the study of the charts, is that there must be a great difference in the skill of the leading surgeons of the world.

Physiotherapy in Medical Practice. H. Morris. 276 pp., illust. \$3.75. Macmillan, Toronto, 1939.

This is a clear and concise summary of electrotherapy and light-therapy. In spite of its title no attempt is made to deal with the two other equally important forms of physiotherapy, i.e., mechanotherapy and hydrotherapy. One feels that the title of the book should draw attention to the limited ground it covers. The book is well divided by subjects into chapters. It is fairly dogmatic, but not too greatly so for the general practitioner.

The chapters on faradism and galvanism are very clear, and a useful table for iontophoresis is included. The usual charts for motor points are provided. Chronaxie is discussed, and a satisfactory machine for measuring it is described. Detailed instructions are given for the use of diathermy in all possible situations. Short wave and inductothermy are very briefly

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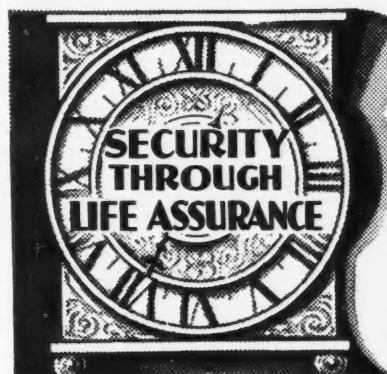
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Gardner—Handbook of Skin
Diseases, 4th edition, 1939 \$3.00

dealt with. No detailed account is given of electro-surgery but it is dealt with under general headings. Ultra-violet radiation is dealt with in detail under three headings, Sunlight, Carbon Arc Light, and Mercury Arc Light. This subject is very well dealt with, in particular the dangers associated with ultra-violet radiation.

The last two chapters are devoted to lists of diseased conditions and their treatment by various physiotherapeutic measures. This cannot be considered altogether satisfactory as no mention is made of massage, corrective exercises or hydrotherapy, all of which could be used in some of the conditions mentioned.

The Immortal Tooth. E. Smason. 271 pp. \$2.75. Macmillan, Toronto, 1939.

"The Immortal Tooth", an easily readable treatise, concerns itself with the part played by the tooth of man throughout the centuries.

It is the first book of its kind written for public consumption in explanation of the multiple and varied mythological, religious, criminal and superstitious accounts in which the tooth has been a nucleus. The reader, be he patient or dentist, is carried along in an increasingly interesting manner from the evolution of the tooth to curious and interesting facts concerning it.

Truly, a book of dental and public interest, enlightening in its presentation and appealing in its humour.

Problems of Ageing. Edited by E. V. Cowdry. 758 pp., illust. \$10.00. Williams & Wilkins, Baltimore, 1939.

The phenomenon of ageing, relatively unimportant to youth, takes on an increasing interest as one approaches that final stage of life. Is there a definite life-span which is incapable of prolongation? The question cannot be positively answered. The expectation of life has been greatly increased in recent years, but this is far from saying that the span of life has been extended. Statistically, there is little evidence to support a contention that the span of life has been increased. For all practical purposes 100 years is the maximum limit and it would appear to have always been so. Experimentally, however, there are some indications that by artificial means the life-span of animals can be prolonged, and, if this is so, one can hope for a similar prolongation of man's life-span.

This book represents the first serious attempt to assemble present day knowledge of the phenomenon of ageing. It is not the work of a single hand, but the result of the collaboration of a large number of men, each an authority in his own field. The various chapters deal with the ageing process in the different systems of the body, and a summary and an extensive bibliography is attached to each.

Although the large number of references quoted might indicate a considerable body of knowledge on the subject, it is probably true to say that comparatively little thought has been given to the problem of ageing. The basic question "Why do we grow old?" still remains unanswered. Why animals should have a life-span at all, and why, in the case of man, this should be set at about 100 years, while other animals reach their dotage in 3 or 5 years, is an enigma. The answer is complicated by the difficulty of distinguishing between disease and physiological senescence. We have not yet established standards of normality at various ages for the different organs, nor are we in a position to detect early signs of disease. The question as to whether arteriosclerosis is a physiological or pathological process, for example, cannot be answered dogmatically, yet this obviously has an important bearing on the problem of whether certain organs are diseased or merely old.

The book is a well done, timely piece of work. The calibre of the writers, the extensive bibliographies, and the comprehensive index make it an invaluable book of reference.

Health Insurance with Medical Care: The British Empire. D. W. Orr and J. W. Orr. 271 pp. \$2.50. Macmillan, Toronto, 1938.

It is probably not due to any fortuitous circumstance that Dr. and Mrs. Orr published their survey of health insurance in Great Britain at this particular time. The medical economic waters on the North American Continent are being stirred as they have never been stirred before, and this book by a young American physician and his wife, who is a trained social worker, presents a viewpoint refreshingly different from those commonly expressed by their compatriots. The Orrs studied National Health Insurance and approved of what they saw. The few adverse criticisms which they record are matters of detail rather than principle, and represent inadequacies in the service which have been pointed out on many occasions by official pronouncements of the British Medical Association.

The interviews which form the basis of this book represent the opinions of insured workers and their uninsured dependents, panel physicians and medical officials, social workers and public health authorities, nurses and school medical officers, insurance committee clerks and trades union secretaries, members of Parliament and officials of the Ministry of Health,—in fact every section of the population seems to be represented. The comment is reiterated again and again,—"The plan of National Health Insurance is a good one, as far as it goes, but it should and will be extended". The authors dispose rather lightly of two important criticisms of the operation of the British scheme of health insurance, namely, that many insurance practitioners have degenerated into mere issuers of certificates, and that overprescribing of medicines constitutes a serious threat to the stability of the whole structure.

One very commendable feature of this book is the manner in which National Health Insurance is related to other sources of medical aid. The trans-Atlantic observer is materially assisted in orientating himself among the various agencies by the brief but adequate descriptions of the Public Assistance Medical Service, the School Medical Service, the Public Health Services with their various clinics, the District Nursing Services, the Voluntary Hospitals, the Public Authority Hospitals, the various medical missions and charity dispensaries, and the thriving plan of voluntary health insurance, the Public Medical Service.

One would have been interested to have read a more detailed analysis of the economics of the National Health Insurance; a discussion of the adequacy or otherwise of the capitation fee, comparing the remuneration of the physician with that of doctors engaged in contract practice on this side of the water; some reference to the administrative cost of the plan, both in its purely medical aspects and in relation to the operation of the Approved Societies; a word on the relationship between the cost of drugs and the amount allotted for medical services; these and other important points await the appraisal of an observer who approaches National Health Insurance with the viewpoint of an administrator.

The final chapter is entitled, "Some Implications for America". This summary, while not unbiased, is worthy of the attention of doctors who live in that portion of America which lies north of the 49th parallel of latitude, as well as of those to whom it is primarily addressed.

The Foreword is written by David Lloyd George, the man who for better or for worse placed upon the Statute Book the Act which brought into being National Health Insurance in Great Britain. He says of the volume under discussion,—"I commend it warmly to the attention of the public, both in Britain and in America", and this reviewer can do no less.